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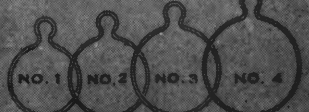

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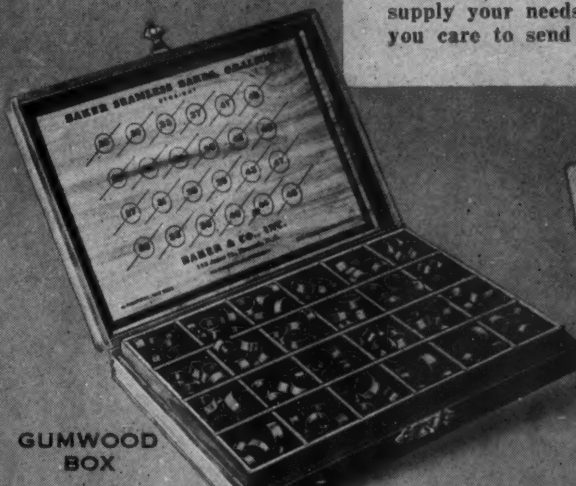

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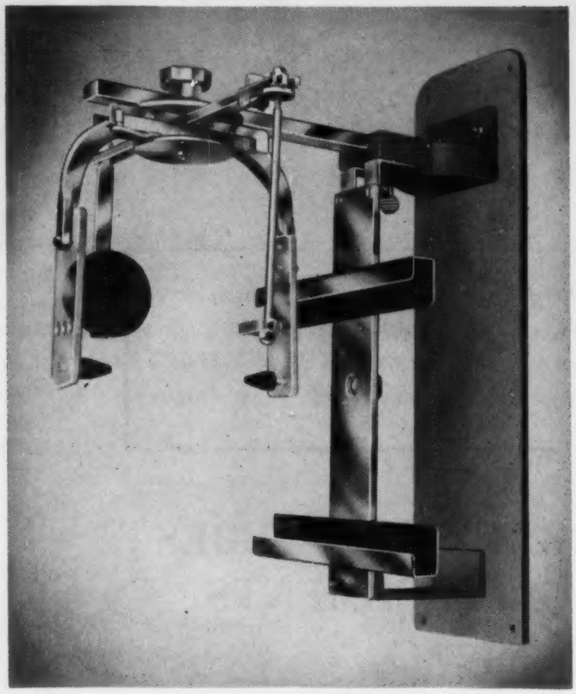

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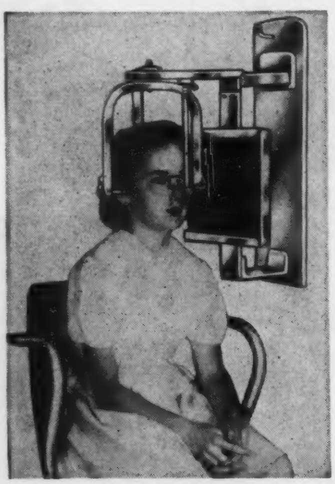

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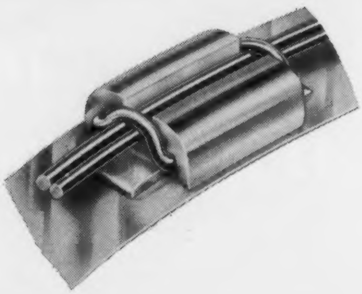

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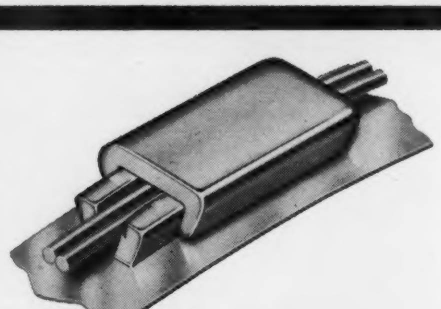

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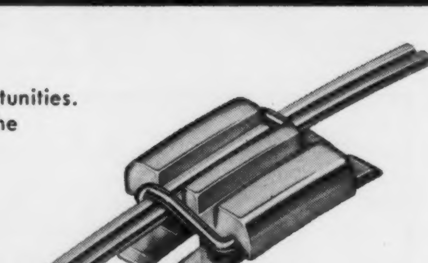

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VOL. 42 NOVEMBER, 1956 No. 11

Original Articles

ADVERSE MUSCLE FORCES—THEIR DIAGNOSTIC SIGNIFICANCE

W. J. TULLEY, B.D.S., F.D.S.R.C.S., LONDON, ENGLAND

APART from the work of Dr. Alfred Rogers, the role of the orofacial muscles received but brief mention in the orthodontic literature up to 1946. Research work on this subject was very limited. Brodie in the United States and Rix, Ballard, and Gwynne-Evans in England have done much to remedy this and have stimulated many others to undertake similar investigations.

Since its initial use by Moyers, the electromyograph is now being used as a dental research tool, giving information which sometimes confirms and also refutes certain theories of the masticatory musculature. This apparatus has some serious limitations and it is not possible to produce a precise quantitative study in the same way as with the cephalometric x-ray. It may, however, be used in a serial study in the future if the results can be carefully interpreted. Workers in this field who are studying the movements of the mandible in relation to various types of malocclusion should make a most valuable contribution to our knowledge.

In this article, however, I am concerned with the study of morphology and function of the soft tissues which immediately surround the dental arches. Rix[17] and Brodie[7] have pointed out that as the teeth erupt they reach a position in balance between the normal or abnormal lingual and labial muscle

From the Dental School, Guy's Hospital, London S. E. 1, England.
Read before the fifty-second annual session of the American Association of Orthodontists, Boston, Massachusetts, May 2, 1956.

forces (Fig. 1). It must be remembered that the distribution and morphology of the soft tissues show as wide a variation as do the type of facial skeleton and the dental arch form. The size and shape of the soft tissues develop as part of the over-all growth pattern and in our research work we should not separate the growing facial skeleton from its investing musculature.

The circumoral muscles originate as primitive elements forming the upper end of the alimentary canal and are initially concerned with the vegetative function of feeding. The basic pattern of their behavior becomes established before birth and suckling movements have been shown to occur in utero. As the child grows older, learned activities (for example, speech and facial expression) which are represented in the conscious levels of the mind become superimposed on this vegetative role of the orofacial muscles, although they are built upon the basic underlying coordinating pattern.[6] Because of man's conscious control of these acquired activities, he differs from the lower animals and is particularly likely to establish faulty habits and uneconomical use of his musculature in childhood, which adversely influence the developing dentition.

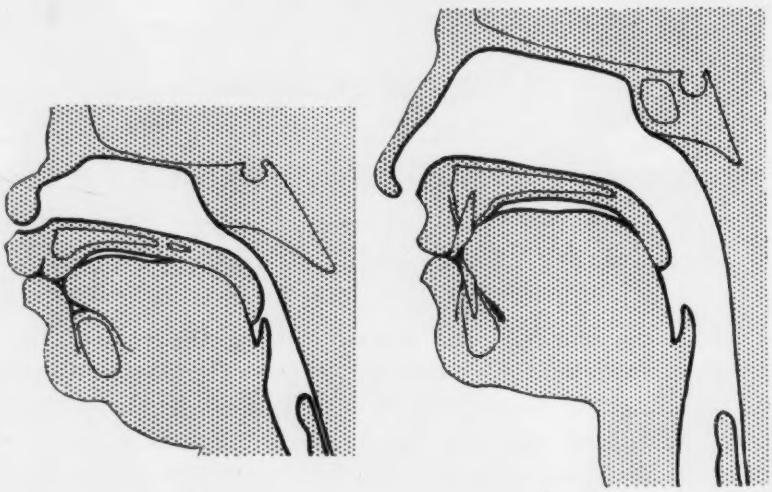

A. *B.*

Fig. 1.—Tongue and lip position at rest. *A*, At birth, *B*, after tooth eruption.

The term "muscle habit" has a wide range of meaning and I would prefer to restrict its use to an acquired abnormal behavior, which is capable of re-education by the provision of a correct sensory appreciation. It is most important to distinguish between muscle habits and the more innate muscular activities.

Brodie[11] points out that, having treated a Class II, Division 1 malocclusion, we may give the lips a chance to function normally, thus overcoming the habit movements that could be secondary to the malocclusion and allow more normal development to continue. This is certainly an important point. In some cases, however, there are an underlying abnormal morphology and behavior

of the lower lip and tongue which may be primary and not secondary to the malocclusion and which tend to produce deterioration of incisor relationship after treatment. It is important to distinguish between what has been called a "mentalis habit" which can be eliminated (Fig. 2) and a particular pattern of lip morphology and function which is part of the physical makeup of the individual person (Fig. 3). Such lip positions are not habits, as they resist re-educational attempts and make it impossible to change permanently the axial inclinations of lower incisors.

A. *B.*

Fig. 2.—*A*, "mentalis habit," sucking in of lower lip in 4-year-old boy. *B*, One year later after elimination of the habit with the Andresen appliance. (From Tulley, W. J.: *D. Practitioner* 2: 196, 1952.)

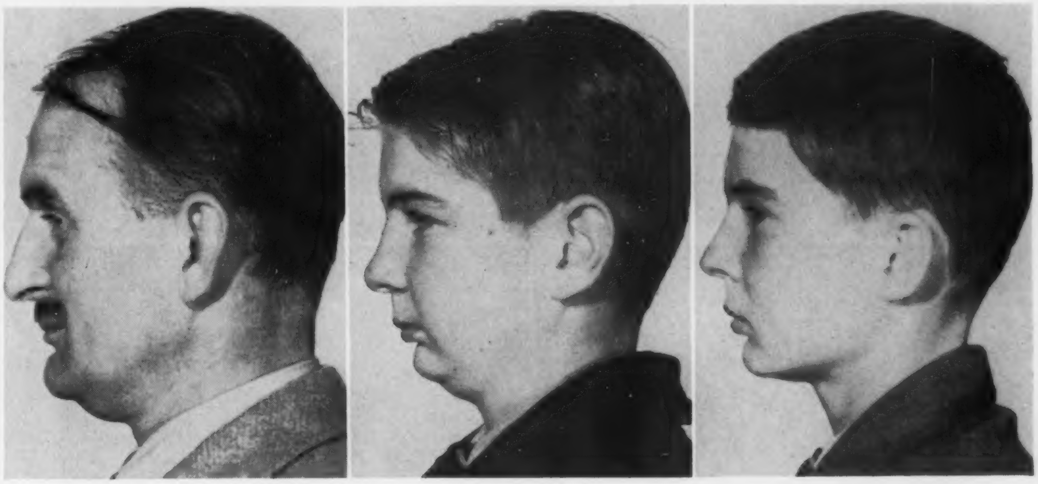


Fig. 3.—Father and two sons with similar lower lip morphology and tension. (Not a mentalis habit.)

Turning attention to the tongue, many habits are ascribed to this organ—for example, tongue lolling, tongue thrusting, biting, and sucking. The tongue readily fills any open-bite created by finger- or thumb-sucking and such habits

Fig. 4.—Persistent contact of lower lip and tongue at rest, in swallowing, and in speech. (From Gwynne-Evans, E., and Tulley, W. J.: *D. Practitioner* 6: 222, 1955.)

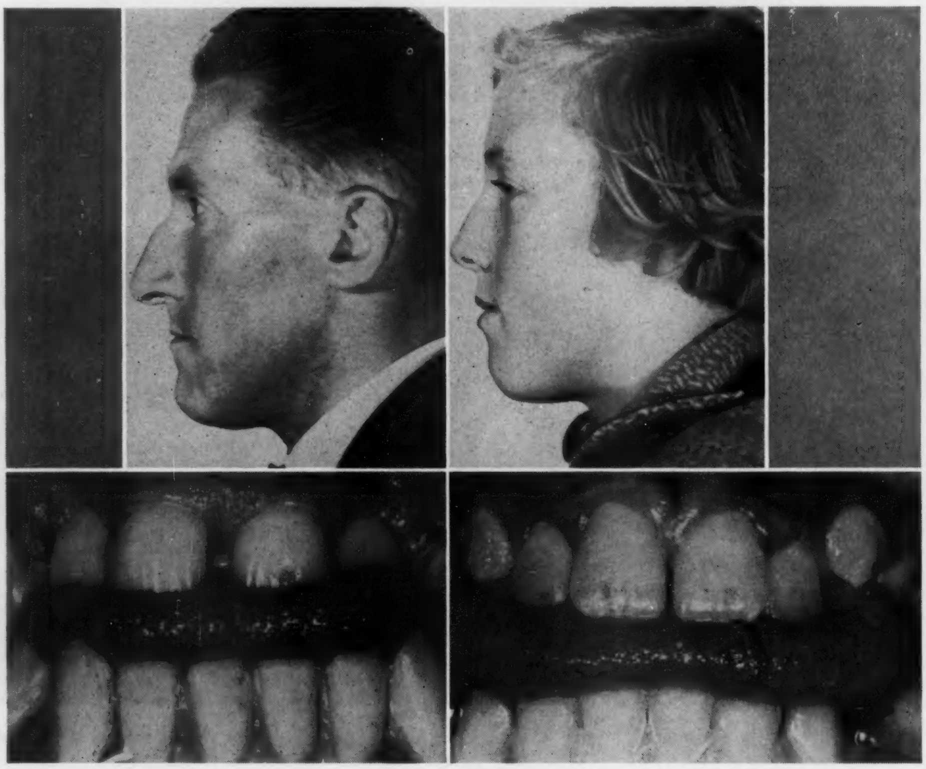


Fig. 5.—Father and daughter with similar tongue resting positions and open-bite. Both have pronounced lisp. (From Pringle: *D. Practitioner* 6: 297, 1955.)

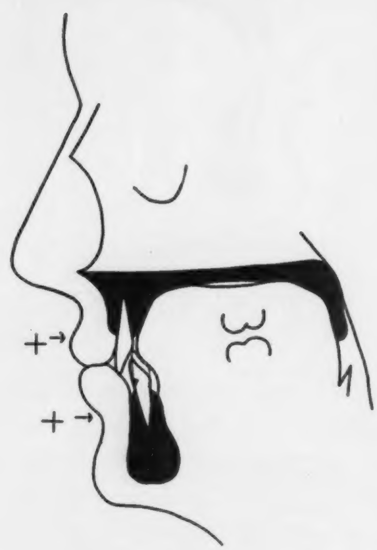
may be eliminated with mechanical treatment of the malocclusion. The resting position of the tongue is important. The question is: How often is its resting position primary or secondary to dental arch form? There is a pernicious and basic behavior of the tongue described by Rix and Ballard which is certainly not a habit. In this, the tongue rests constantly against the lower lip and thrusts or spreads forward to meet the contracting lower lip in swallowing and speech (Figs. 4 and 5). This tongue position is reminiscent of the neonatal tongue-lip contact[19] (Figs. 1 and 4). Lisping speech accompanies this behavior and may be found in several members of the family. The speech therapist may overcome the lisp but fails to change the basic pattern of tongue behavior. This is a poor prognostic sign in cases where an attempt is being made to treat an open-bite.

Fig. 6.—Normal activity of tongue and lips in the first stage of swallowing. Teeth are together, lips relatively passive, tongue bulges into the palate and backward into oro-pharynx. (From Pringle: *D. Practitioner* 6: 297, 1955.)

Atypical behavior in the first stage of swallowing described by Rix[17] in 1946 has occupied a prominent part in the British orthodontic literature. The term "habit" should not be used to describe this, as swallowing is a basic vegetative function below the conscious levels of the mind. Rix[17] and Whillis[26] pointed out that the teeth are usually placed in light or firm contact during swallowing at the time when the mylohyoid muscle contracts. The tongue bulges into the palate, centrifugally against the teeth and backward into the oropharynx (Fig. 6). After the age of 5 to 7 years, this is the usual behavior during swallowing of hard foods after they have been masticated, and it occurs frequently during the day and night in the act of "basic swallowing" which redistributes saliva and removes excess. Exceptions occur when succulent and juicy foods are swallowed; then the teeth are not placed in contact. Rix observed that a high percentage of children with malocclusions

always swallowed with the teeth apart. The tongue in these cases was not acting in a rigid-walled cavity. The tongue space was increased and this meant that the tongue was not thrust strongly against the teeth and developing palatal vault and did not balance adequately the external forces of the cheeks and lips contracting in many varying degrees to effect an anterior seal (Fig. 7).

A.



B.

Fig. 7.—*A*, Marked lip contraction in "teeth apart" swallow. (Extracted from cinefilm.) *B*, Diagram showing excessive lip activity and tongue pressure not counteracting this. The "blunt tongue" swallow.

An account of the various theories that have been put forward as to the origin of this atypical swallowing behavior must, of necessity, be brief but these theories are included as they shed some light on the clinical aspect. Rix, in his original paper, suggested that the "teeth apart" swallow was a residual infantile behavior and that maturation might be delayed in the presence of

upper respiratory obstruction and infection. He pointed out that with nasal obstruction the "teeth together" swallowing is uncomfortable and that if upper respiratory troubles were dealt with early the behavior might tend to change. However, Gwynne-Evans and Ballard, in 1948, believed it to be an infantile pattern of behavior due to some delay in maturation of neuromuscular behavior at the cortical level and not related to upper respiratory infections. They thought that a change could be encouraged by exercises and appliances, such as the Andresen appliance, designed to provide the correct sensory appreciation of the tongue acting in a rigid-walled cavity. The results of this attempt at re-education were disappointing. Recent papers by these authors have shown some modification in the original theories, but Rix maintains that there is a similarity between certain types of "teeth apart" swallow and the infantile suckling behavior. He has shown that changes may

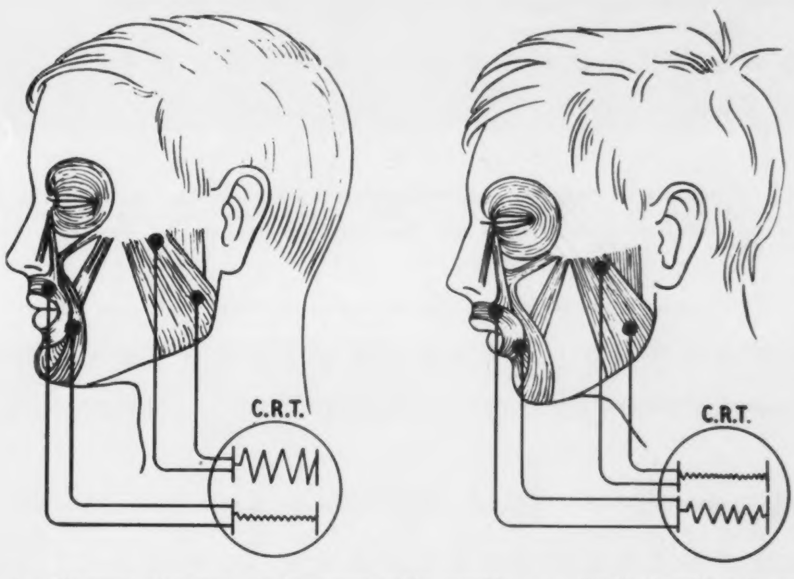
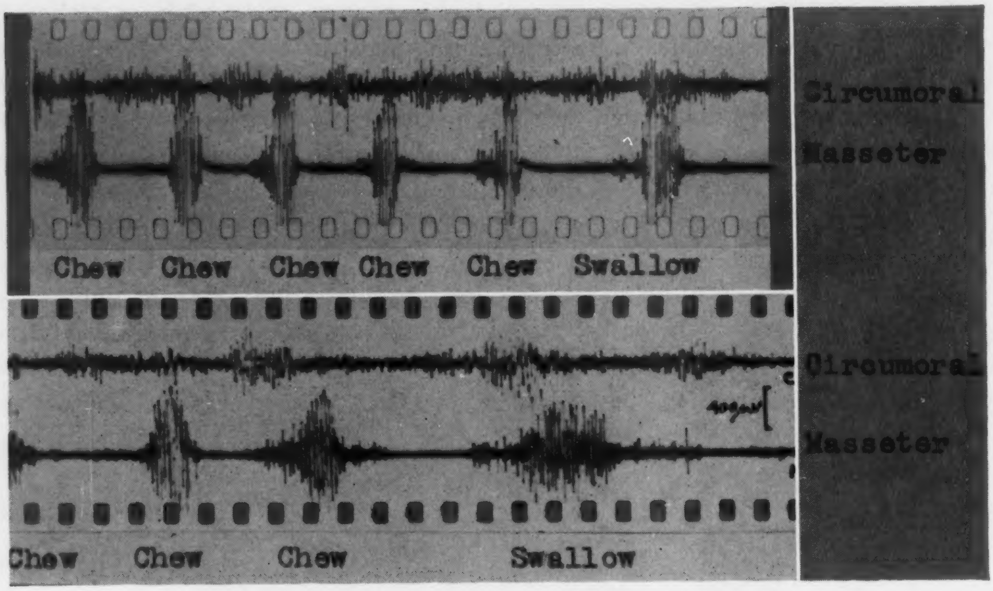


Fig. 8.—Diagram showing electromyographic results. *A*, Teeth together in swallowing, strong masseteric contraction, and slight lip activity. *B*, Teeth apart in swallowing, very little masseteric activity, strong lip activity. C.R.T., Cathode ray tube.

occur with orthodontic treatment. Gwynne-Evans holds the view that the atypical swallowing behavior, with its peristaltic-like contraction of the circumoral muscles, is an expression of a "visceral type" of behavior, the muscles of the face occupying a developmental position between the somatic musculature controlled by the central nervous system and the visceral musculature controlled by the autonomic nervous system. Ballard now believes that these patterns of behavior are inherent and very resistant to change.

Using the electromyograph as evidence, I have studied a group of students between 20 and 30 years of age.[23] By recording from the masseter, it is possible to determine whether or not the teeth are placed together in swallowing. The masseter muscle normally contracts strongly during the phase of the

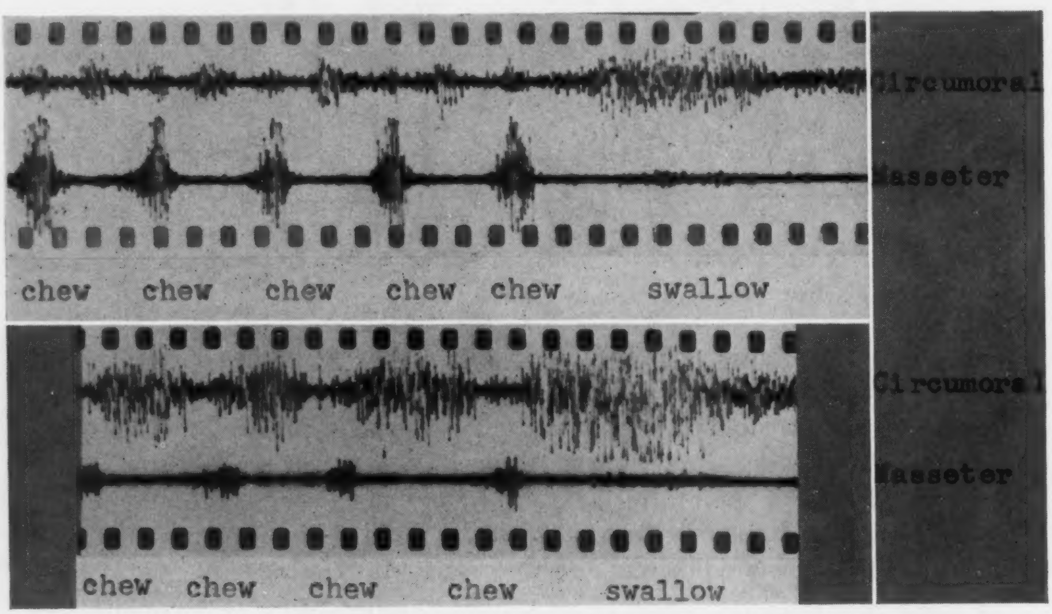
A.



B.

Fig. 9.—Examples of chewing and swallowing crackers in the normal way, with teeth together. (Electromyographic records.) *A,* Note strong masseteric contraction in swallowing. *B,* Note alteration of circumoral and masseteric contraction in chewing. Strong masseteric activity in swallowing.

A.



B.

Fig. 10.—Examples of cases with malocclusion, swallowing without strong masseteric contraction but with excessive lip activity. (Electromyographic records.)

mylohyoid contraction to hold the teeth in firm contact. By recording simultaneously from the group of circumoral muscles, it is also possible to illustrate the amount of lip activity (Fig. 8). Typical records for the "teeth together" swallow are shown in Fig. 9. The masseteric contraction is marked and the circumoral contraction is minimal. In Fig. 10, where the teeth are apart in swallowing, the masseteric contraction is slight compared with the circumoral activity. The results of these investigations show that the "teeth apart" swallow is present in a large number of adults, particularly if they have any degree of malocclusion.

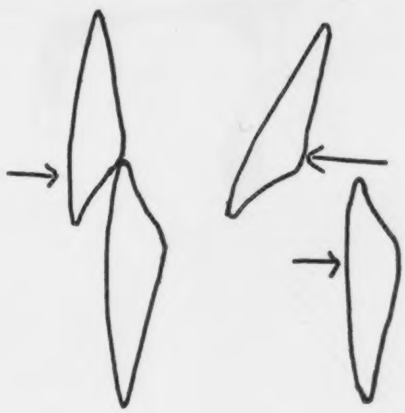


Fig. 11.—Varying incisor inclinations resulting from abnormal soft tissue forces. *A*, Close adaptation of incisors with tendency to retroclination. *B*, Dispersal of incisor relations.

It is impossible to cover all aspects of atypical swallowing behavior here, but among the whole range of variations described by Rix[19] in 1953, two sharply contrasting types are recognizable:

1. *Nondispersing behavior of tongue:*

   Those cases in which the tongue does not come forward to exert any force on the lingual surface of upper and lower incisors. The lips may or may not contract excessively. The upper and lower incisors are upright or retroclined (Fig. 11, *A*).

2. *Dispersing behavior of tongue:*

   Those cases in which the actions of tongue and lips are associated with a dispersal of upper and lower incisor relations (Fig. 11, *B*).

In the film study, variations of these two themes are shown. Fig. 7 illustrates the effect of excessive contraction of the circumoral muscles in swallowing, which must be a contributory factor in the lack of centrifugal development of the dental arches that is found in some Class I cases. The lips may not be sealed at rest, but contract excessively when active. There is a particular type of Class I malocclusion with retroclination of upper and lower incisors and a deep overbite which is associated with the nondispersing action of the tongue. The constricting effect of the lips is not counterbalanced by a forward spread of the tongue, which stays back in the mouth.

Fig. 12.—Soft tissue morphology and swallowing activity in Class II, Division 2 malocclusion. Teeth well apart in swallowing, tongue does not thrust forward, lower lip acting high on labial surface of 1/1. (From Pringle: *D. Practitioner* **6**: 297, 1955.)

A. *B.* *C.*

Fig. 13.—Types of Class II, Division 1 Malocclusion. *A*, With normal skeletal relationship with occlusion Class II, Division 1. "Teeth apart" swallow with lower lip contraction and tongue thrust. *B*, With Class II skeletal relationship (mandibular retrusion). "Teeth apart" swallow with strong tongue thrust. *C*, Class II, Division 1 with "teeth together" swallow, lower lip not active—its position secondary to the jaw relationship. (From Pringle: *D. Practitioner* **6**: 297, 1955.)

A similar type of behavior may be found in Class II, Division 2 malocclusions and Rix refers to this as the "blunt tongue" swallow (Fig. 12). With the tongue held back between the arches in this way, a cross-bite is rarely seen. It does not necessarily follow that the lip activity is excessive, but there is no forward tongue pressure on the incisor segments. Improvement in the axial inclinations of incisors will depend on the possibility of modifying these atypical forces.

In Class II, Division 1 malocclusions the action of the tongue and lower lip may be responsible for the dispersal of the incisor relationship (Fig. 13). When this action is strongly adverse, the stability of the end result may be jeopardized. If the relative position of the lower lip is changed by retraction of the upper incisors, it may act on their labial surfaces to retain these teeth but produce secondary effects on the lower incisors causing them to imbricate.[16]

A. *B.*

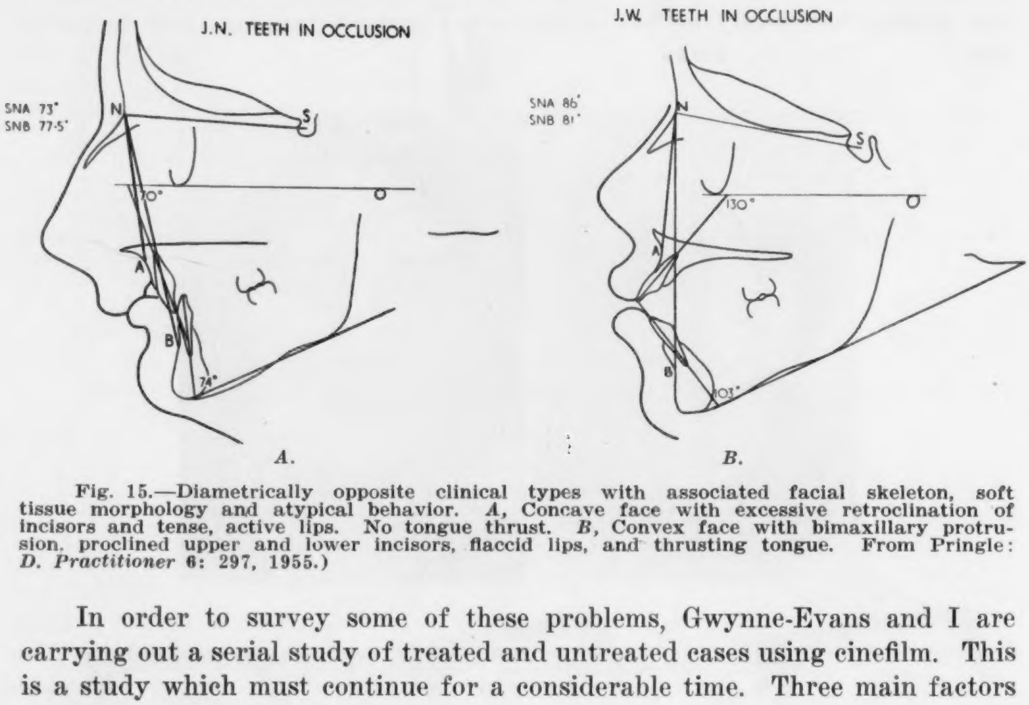
Fig. 14.—Maturation of facial expression accompanying orthodontic treatment. *A*, Age 9; *B*, age 23. (From Pringle: *D. Practitioner* 6: 297, 1955.)

Having explained some of the differences between muscular habits and more fundamental innate muscle forces, there is another aspect to discuss from the prognostic viewpoint, that is, the question of whether all these abnormal forces remain resistant to change because of their innate biologic background.

Ballard[6] has presented a rather pessimistic picture of the immutability of some types of behavior. I agree with him up to a point, but we all see remarkable changes taking place in the faces of our child patients as they grow older (Fig. 14). We also notice remarkable changes in children when we do no more than observe them. This is true of the child with lack of lip seal where there is no interference of the incisors between the lips. In many of these cases the children are not mouth breathers and improvement occurs unless there is a major discrepancy between the length of the upper lip and that of the teeth and alveolus.

The answer to many of these changes lies in the fulfillment of the growth potential not only of the skeleton, but of the soft tissues also, and in the maturation of the facial musculature which takes on the adult "mask." With the increasing worries of raising a family and of income tax, we do not expect to see the same lax lip positions of childhood. With the desire of the young lady to appear attractive, we do not see the same "deadpan" face of the preadolescent.

It is most important, in making a prognosis, to decide whether the morphology and function of the soft tissues constitute such a dominant factor, taken into consideration with the facial skeleton and the dentition, as to form part of a definite facial type that cannot be appreciably changed (compare *A* and *B* in Fig. 15).



A. *B.*

Fig. 15.—Diametrically opposite clinical types with associated facial skeleton, soft tissue morphology and atypical behavior. *A*, Concave face with excessive retroclination of incisors and tense, active lips. No tongue thrust. *B*, Convex face with bimaxillary protrusion, proclined upper and lower incisors, flaccid lips, and thrusting tongue. From Pringle: *D. Practitioner* 6: 297, 1955.)

In order to survey some of these problems, Gwynne-Evans and I are carrying out a serial study of treated and untreated cases using cinefilm. This is a study which must continue for a considerable time. Three main factors are illustrated in the film:

1. Muscular habits than can be eliminated.
2. Modification in behavior with growth and maturation, with special reference to swallowing.
3. Fundamental patterns that are unchangeable in both morphology and function.

All these factors have to be taken into consideration in making a diagnosis and prognosis, and much of this can be decided only on clinical experience. If, however, patients are kept under observation and simple guiding treatment for a time and are followed with serial cephalograms, as advocated by Broadbent, a better assessment can be made of the need for active treatment and its ultimate stable success.

Two main practical points emerge from this discussion. First, it is appreciated that with the multi-band technique the experienced orthodontist can move teeth where he will and in many cases achieve stability, a sign that the muscle forces may be adaptable. However, if we are honest, we all have a percentage of cases that are not stable even with prolonged retention. It is toward a better understanding of these that this study is directed.

There is no doubt that Angle recognized these problems but would not accept the fact that in certain cases they were insurmountable. In the appendix to the seventh edition of his *Malocclusion of the Teeth,* he states: "We are just beginning to realize how common and varied are the vicious habits of the lips and tongue, how powerful and persistent they are in causing and maintaining malocclusion, how difficult they are to overcome.

"The period of retention of the teeth after they have been moved into normal occlusion is one of the most important in treatment and so complicated and persistent are the delicate forces that tend to derangement of the established occlusion as to necessitate the most thoughtful consideration of the problems involved and a degree of skill in overcoming them which much experience alone can develop, even among those with talent for the work."

The second point is that I do not believe that swallowing behavior can be changed by exercises alone unless it would have modified anyway with routine treatment. It may be possible to train a child to swallow properly when in the office and by conscious effort he will repeat it correctly every time he comes, but he does not think every time he swallows during the day and night.

SUMMARY

The role of the circumoral muscles in influencing tooth position has been discussed. Emphasis has been placed on the necessity to distinguish between bad muscular habits, which can be eliminated with treatment and exercises, and the more innate behavior which may resist change. It is this subtle difference which is so important in assessing stability of repositioned teeth. A serial study by cinefilm has shown examples of habit elimination and the persistence of more basic behavior.

My thanks are due Mr. R. E. Rix and Mr. K. E. Pringle, for their help and encouragement; Mr. E. Gwynne-Evans, with whom I have been privileged to work in the Upper Respiratory Research United, Guy's Hospital Medical School; Miss Treadgold, Mrs. Rawlins, and Miss Whiteley, for the illustrations, and Mr. Colewell, for the acrylic models.

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CINEFLUOROGRAPHY WITH IMAGE INTENSIFICATION AS AN AID IN TREATMENT PLANNING FOR SOME CLEFT LIP AND/OR CLEFT PALATE CASES

HERBERT K. COOPER, D.D.S., D.SC.,* LANCASTER, PA.

THE purpose of this article is to display the use of cinefluorography with image intensification as an aid to better diagnosis and treatment planning in some cleft palate cases.[1] Although this discussion will be devoted mainly to cleft palate and cleft lip, the techniques described can be adapted to the study of other problems of equal importance to the orthodontist; these problems include the temporomandibular joint, thumb-sucking, lip or tongue habits, etc.

There are many specialties of medicine, dentistry, and allied professions which have an interest in the physical restoration, habilitation, and/or rehabilitation of the person with cleft lip and cleft palate. Each, in his own field and with his own techniques, at some time has something to contribute if the end result of treatment is to be successful. We are living in an age when specialty training and specialty practice are very acute. Boundary lines are being established and challenged. It is only natural, then, that one is likely to place more emphasis on his own specialty. As a result of training, one's thinking is bound to be focused on his own area of interest, and when several specialties have the same area of interest, with different techniques involved for solution, some delicate situations can arise. That is one of the dilemmas caused by specialty practice today.[2]

As time goes on, we see a more general acceptance of group thinking, or team approach, in our treatment planning.[3] We feel that the tendency to relate the group as to the relative importance, one to the other, should be avoided. In the September issue of the *Journal of Plastic and Reconstructive Surgery,* in a paper by Tressler, Bauer, and Tondra,[4] we find the following: "The cleft palate–cleft lip rehabilitation clinic is an important addition to the plastic surgical department of a teaching institution. The clinic should have an honest, wholehearted collaboration between the plastic surgeons and number of consultants, including pediatrician, pediodontist, orthodontist, speech therapist, audiologist and prosthodontist. When needed, the psychometrist and the social worker should be available.

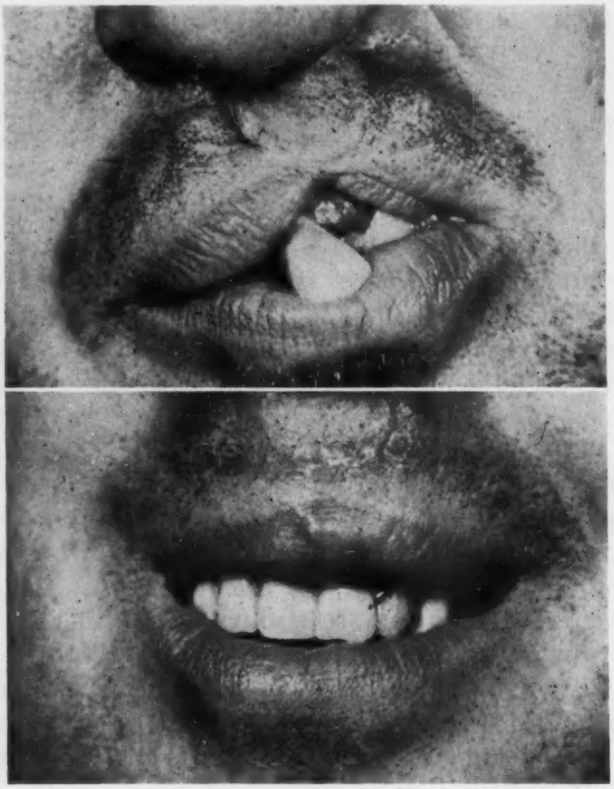
"It is obvious that this group will function best when the consultants agree to act in an ancillary capacity to the surgical service."

Read before the American Association of Orthodontists, Boston, Massachusetts, May 3, 1956.

*Director, Lancaster Cleft Palate Clinic, Lancaster, Pennsylvania.

To me, that approach seems very one-sided. We believe that at different times, in different cases, each of the specialties can become ancillary to the others. In many Type III and Type IV cleft lip cases, it would be difficult to determine who should act in a subservient capacity. Each helps the other (Fig. 1).

A.



B.

Fig. 1.—*A* and *B*, Result of group planning and treatment.

Some dentists have made statements condemning surgery on the palate. Some plastic surgeons have condemned the use of prosthetic appliances as an aid in producing acceptable speech. In fact, surgeons have told me that they never saw a cleft which could not be closed by surgery. We believe that to be true, but merely closing the opening does not necessarily insure presentable speech. In fact, a distist can well make the same statement about closing the opening with an appliance. It all depends on the ultimate objective. It is hoped that the technique described in this article will establish, at least in part, a workable basis for determining what procedure is best for a given case.

An editorial[5] in a recent issue of the *Journal of Plastic and Reconstructive Surgery* sums up this part of the discussion as follows: ''Any surgical closure of

the palate should have as its objective the creation of a velopharyngeal sphincter and if this cannot be accomplished, then the validity of surgical treatment of this phase is debatable."

This article is written in an attempt to show that physiologically good results do not always accompany a good anatomic closure (Fig. 2). It is possible that some of us, regardless of methods and techniques used, have been looking at our results from the standpoint of a mechanically good anatomic restoration and forgetting the problem of function. Speech therapists have been asked by

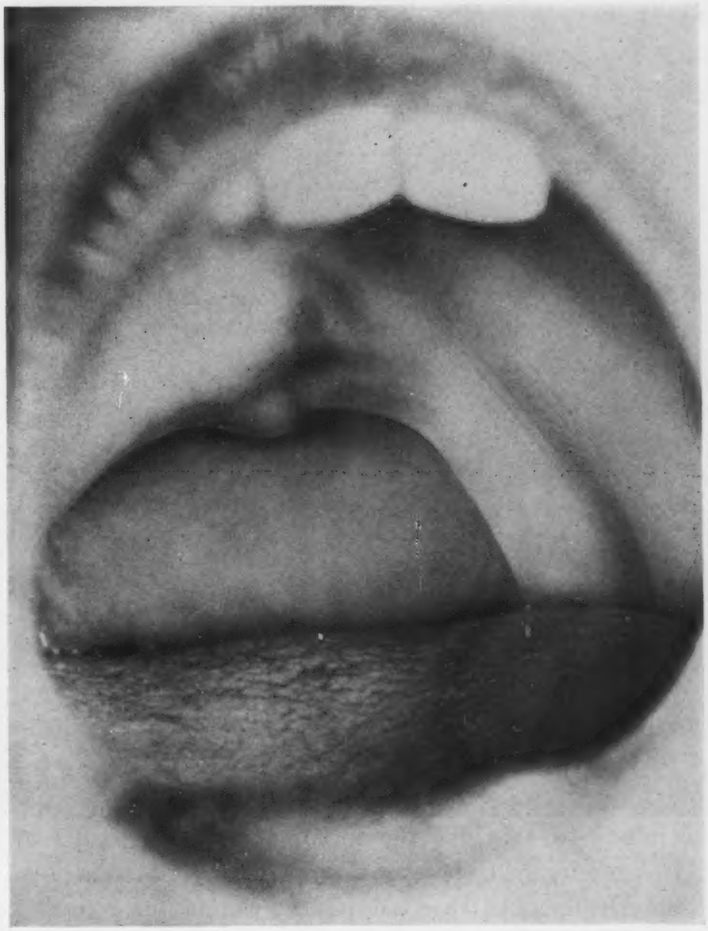


Fig. 2.—Good closure, but speech is very poor. (See Fig 3.)

both the surgeon and the orthodontist to attempt to establish a presentable speech pattern in patients not capable of responding to speech therapy. We in the Lancaster Clinic are now trying to focus our interest *more* on the activity of the structures involved.

Our interest in this phase of the treatment stems from the fact that too often we attempted the construction of an obturator after function had been disturbed to the extent that a good speech result was impossible. It should be

stated here that at no time do we believe there is any *magic* in an obturator. We do believe, however, that there are many cases in which its use seems to be the only means of improving the speech. In such cases it fills a definite need. We in Lancaster feel that the use of an obturator simply as a means of last resort is poor procedure. We feel that better treatment planning in the original diagnosis would eliminate many of these difficulties. (To attain a satisfactory result in the treatment of the cleft lip, cleft palate, or other dentofacially handicapped patients, the objectives should include: masticating efficiency, esthetic facial harmony, socially acceptable speech, and psychologic adjustment to the condition.)

Fig. 3.—Radiograph showing short palate. The next step to insure acceptable speech is the point in question here. Speech therapy alone is not often successful in this type of case. A decision as to further treatment must be made—more surgery, or an obturator?

Since good speech requires proper velopharyngeal valving, it behooves all interested specialists to consider the importance of this part of the speech mechanism. The tendency has been to close the cleft somehow, either surgically or prosthetically, and then advise the patient or parent that all that is necessary in the future is "speech therapy." Speech is a learned function, as differentiated from seeing or hearing. We learn to talk by using structures intended by Nature for other purposes. Voice quality, then, depends, in part at least, on a good valving mechanism with proper resonance. We would not think of giving a child a violin with only one or two strings, or a trumpet with one of the valves stuck, and then asking a music teacher to teach him to play it. (Expecting the child to learn to play is the point in question here.)

In the past, most of our examinations of the postoperative case consisted of looking into the throat and having the patient swallow or say, "Ah." Later, radiographs were found helpful in studying length of palate or position of

speech appliance. When we looked into these throats of postoperative patients and saw some movement in the region of the soft palate, we thought that all that was necessary was speech training.

For many years we have been seeking a better method of diagnosis in outlining a further treatment plan in these postoperative cleft palate cases. Radiographs were quite helpful (Fig. 3) but, since a study of parts in motion was involved, their use was limited. Cinefluorography could be used, but the danger of overexposure was too great to be used as a routine procedure. Before image intensification, the ordinary fluoroscopic image was too low in brightness to use in taking motion pictures. Not only is observation of such a dim image very fatiguing, but also the capacity for detail perception is limited at these low levels. The screen material was next improved, but this was not

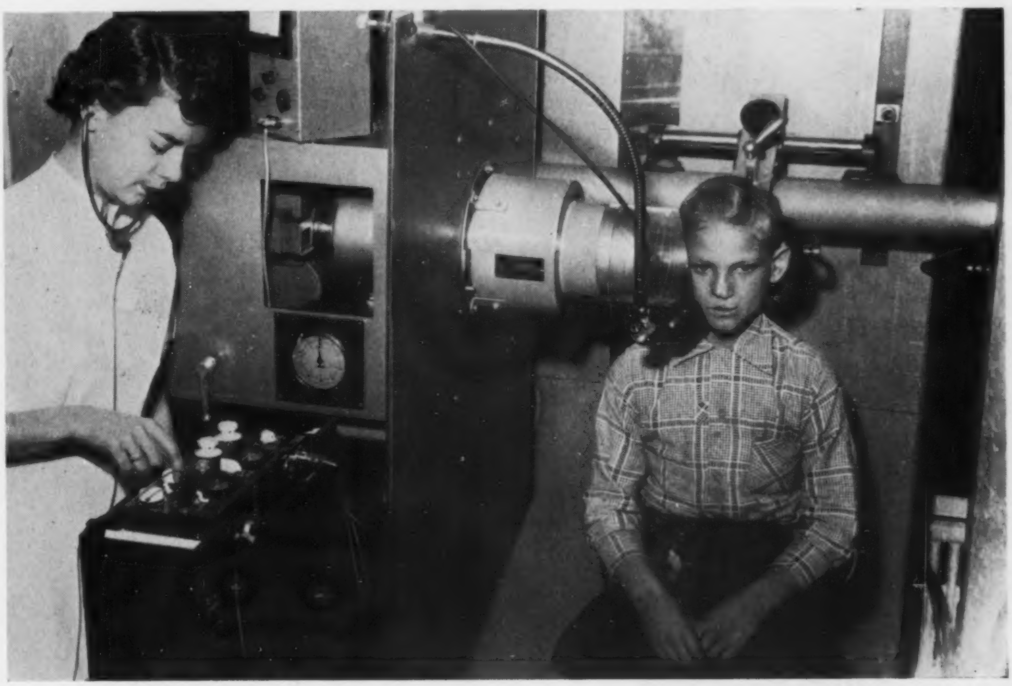


Fig. 4.—Cinefluorographic unit (tube and control panel not shown). Speech is recorded on same film at same time.

enough. Increasing the x-ray dose to produce brighter image was impracticable because of danger to patients. The solution was finally found in electronics. With the advent of image intensification, another door has been opened.

In 1934, Philips patented a new tube constructed on the basis of the image converted (Fig. 4). This tube not only replaces the ordinary fluoroscopic screen, but in doing so it produces an image 1,000 times brighter than that of the conventional screen, with only a fraction of the dosage. As an example of this, it is now possible to take 100 feet of 16 mm. film with the x-radiation need in taking a radiograph of one tooth of four seconds' exposure with the average dental x-ray machine.

Reducing radiation dose (Fig. 5) to the patient is an important consideration in any x-ray study. By proper selection of films and special processing of them in our own laboratory, we are able to eliminate still more radiation to the patient. The employment of certain radiographic filters also lowers the x-radiation during each study.

Speech is now recorded on the same film at the same time the cinefluorography is done. This is proving to be an invaluable aid also in planning future procedures. In combination, the above factors provide us with the advantage of dynamic sound motion pictures at the low rate of 1.6 roentgen units for a full minute's exposure. Again, for comparative purposes, 69 roentgen units per minute is the lowest figure listed as the output of the average dental x-ray unit.

WISSAHICKON 7-8637

THEODORE E. SOPP
RADIOLOGICAL PHYSICIST
1630 WOODBROOK LANE
PHILADELPHIA 19, PA.

Radiation Report to:

Lancaster Cleft Palate Clinic
24-26 North Lime Street
Lancaster, Pennsylvania

Apparatus Calibrated:

Philips Image Amplifier
X-ray Unit

X-ray Output -- Measured at -- END OF CONE

R/min.	KV.	MA.	Filter's used	T.S.D.*
24.8	75	5.0	1.0 mm Al	31 cms
4.4	75	5.0	0.27 mm Cu	31 cms

X-ray Output -- Measured at -- SKIN SURFACE

R/min.	KV.	MA.	Filter's used	T.S.D.*
9.2	75	5.0	1.0 mm Al	51 cms
1.6	75	5.0	0.27 mm Cu	51 cms

* Target Skin Distance

Fig. 5.—Copy of report of radiological physicist. Dosage can be reduced more by selection of film and special processing.

I would like to give credit here to the Gustavus and Louise Pfeiffer Research Foundation for making it possible for us to acquire this equipment. With the purchase of this complex electronic device, however, came a need for trained personnel to insure optimum results. To fill this need, an electronics engineer was appointed to our staff as Director of Technical Research. We were greatly encouraged in this move by reading an editorial in the October, 1955, issue of *Radiology Magazine*,[8] which stated: "Electronics engineers should be aware of medical problems in which electronics can be of help, and members of the medical profession should know where and how to present their problems to the engineers."

Through the same Foundation, we were able to acquire another valuable piece of equipment, the sound spectroscope (Fig. 6). The sound spectroscope development project was started in the Bell Laboratories in 1941. The war at that time emphasized the military application of, and need for, a visual translation of sound, and during that period the interest was centered upon those military requirements. With this instrument, we now have an aid to study speech sounds in a form that can be read. Heretofore we were dependent on what we heard, which at times was not accurate information. With visible speech, we can now study speech in three dimensions.

Fig. 6.—Sound spectroscope. With this apparatus, speech sounds are translated into a form which can be read.

Visible speech gives the speech therapist a graph (Fig. 7) that can be analyzed quantitatively. The therapist is confronted with a special situation in each individual case. There is no doubt that an experienced ear and eye can tell a great deal from the test situation that usually makes up the diagnostic interview. The techniques presently employed in diagnosis can be helped greatly by the evidence contained in the visible speech patterns (Fig. 8).

In using together the cinefluoroscope with image intensification and the sound spectroscope, we are finding some revolutionizing facts. In the study of the soft palate in normal function, we find that the greatest pharyngeal closure is always above the external tubercle of the atlas bone. Much has been written about Passavant's pad or cushion. It has been stated that this pad is the point of greatest constriction of the superior constrictus muscle, and that its forward movement is present in normal speech. Our finding to date does not bear this

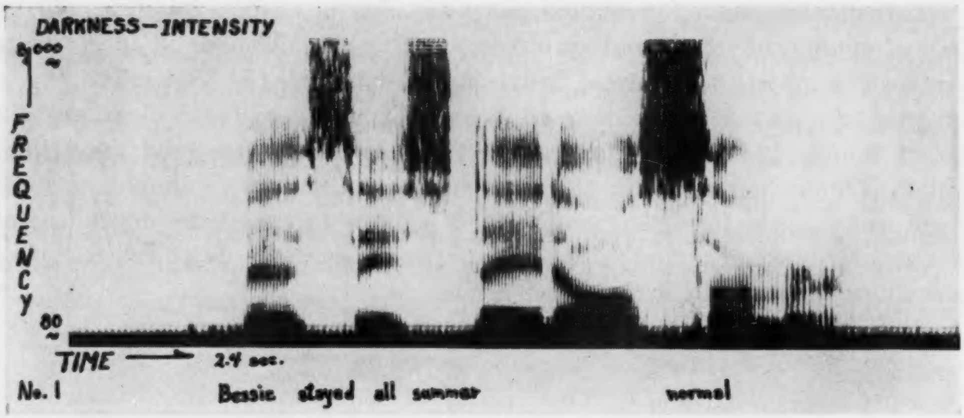


Fig. 7.—"Normal" visible speech graph in three dimensions—time, cycles, and intensity.

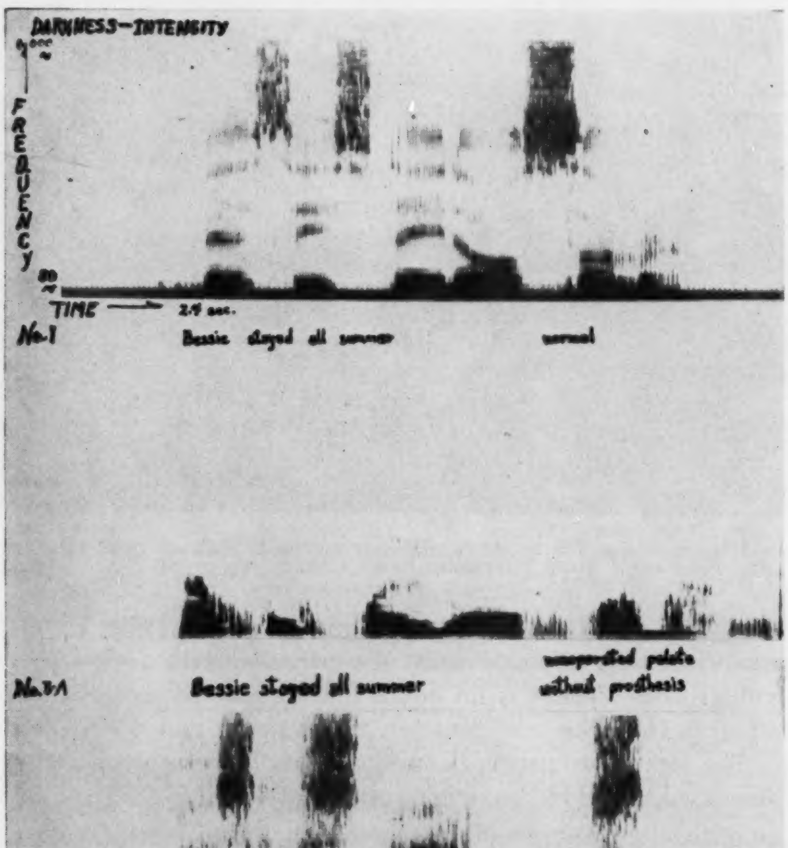
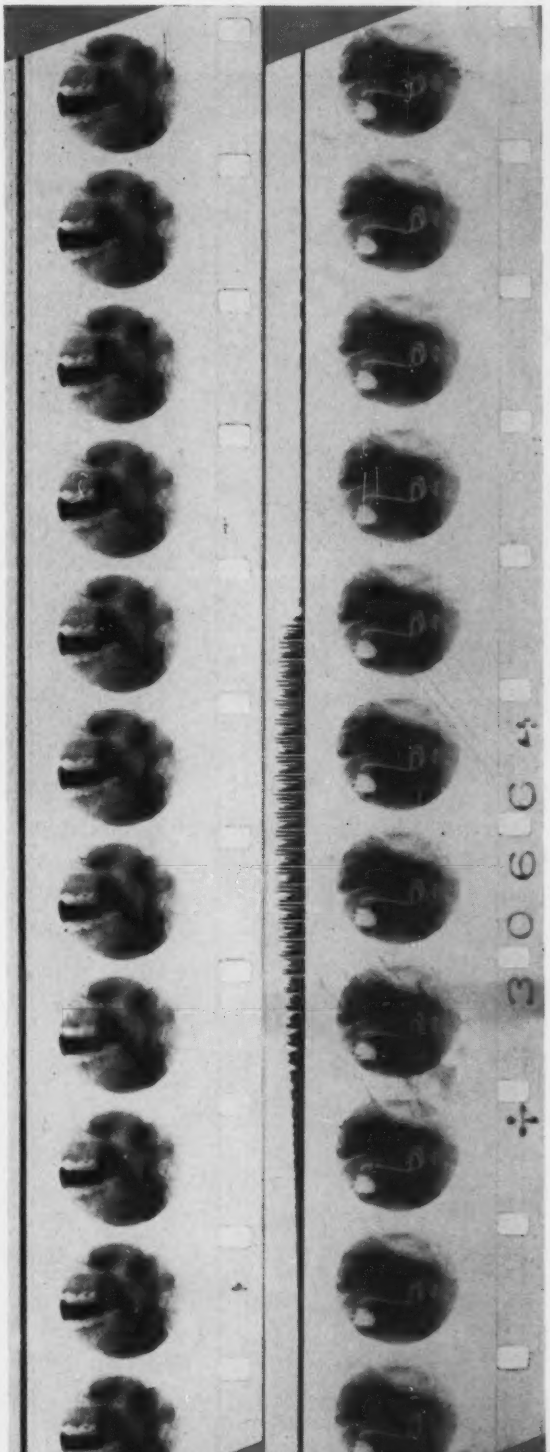


Fig. 8.—Progress speech graph No. 1. *1-A*, Normal; *3-A*, speech graph on admission; *3-B*, graph after seven weeks of treatment (prosthesis and speech therapy).



A. *B.*

Fig. 9.—*A*, Several frames of motion picture of normal palate. *B*, Showing prosthetic speech appliance. All these have sound attached.

A. B. C.

Fig. 10.—*A*, *B*, and *C*, Cinefluorography with image intensification is helpful in studying movements of the lip and tongue.

out. It is only in some of the cases in which the palate is short that we find evidence of this forward movement. It actually seems as if Nature is making a compensatory effort to aid in the valving mechanism in cases of a short soft palate.

The cinefluoroscope is a great aid also in helping our team to decide whether to operate further or to advise construction of an obturator for a given postoperative case. We hesitate to advise redivision of the soft palate, but where it might be considered, motion pictures are a decisive factor in the procedure.

In the placing of an obturator, we are finding great assistance in these motion pictures. As orthodontists, we are continually trying to control the forces we employ to move teeth in order to eliminate traumatizing the tissues. Where an obturator is used, great care must be taken to avoid placing too much stress on the teeth. It is possible to construct a speech appliance which can work antagonistically to all the laws of good orthodontic procedure. With the extension necessary to add a tailpiece and bulb to the palatal section, a mechanically unscientific situation can be created. In cases where the superior constrictor muscle moves forward, much pressure can be applied to the whole appliance and thereby disturb not only the retention of the appliance, but also the entire arch and occlusion. This is particularly true where serial clasps with thimble crowns are used. This whole mechanism can actually work as an orthodontic appliance in reverse.

We feel that the speech bulb should be placed just above, not opposite, the point of the greatest constriction as shown by the pictures when making the plan for treatment. We find that the best voice quality in normal persons (Fig. 9) is where the soft palate closes in the higher position. By placing the speech bulb always above this constriction, we are getting better voice quality as well as a better velopharyngeal seal without disturbing the retention of the appliance.

Another group of cases which present a pressing problem to the orthodontist are the Type III and Type IV cleft lip cases associated with a loose, missing, or disturbed premaxilla (Fig. 10). With better surgical procedures, we are not seeing them as frequently. However, they still are being presented for treatment in sufficient number to warrant discussion of them. We are greatly indebted to Dr. Joseph D. Eby, of New York, for his helpful suggestions in handling this type of case. In all cases where the premaxilla is involved or where the growth of the maxilla has been disturbed, more attention should be given to the mandible. In most of these cases, by removing the lower first premolars and bringing the lower anterior teeth back, the profile jaw is improved in appearance. The prognathic or pseudo-prognathic jaw appearance can be a very severe handicap to the person so afflicted. In planning for the treatment and in the actual treatment, cinefluorography is very helpful in studying the lip and tongue function in speaking and swallowing.

SUMMARY

Because of different training and techniques, one is prone to place emphasis on treatment in a particular field, thereby producing a dilemma in the minds of the professional personnel as well as the patient. We hope to avoid some of the attendant confusion which only adds to the trauma already present in the patient and his family. The importance of a long-range view of the whole cleft palate problem is stressed.

By the use of cinefluorography with image intensification, together with the sound spectroscope, we can study the physiologic action of the pharyngeal muscles, soft palate, tongue, lips, etc., in producing normal speech; by comparison with the norm we are able to determine and establish a better diagnosis for the treatment plan in the postoperative case where speech is poor and the velopharyngeal sphincter action is faulty. (We feel that in the future the cinefluoroscope with image intensification will be used effectively in constructing teaching films of other anatomic parts in motion of interest to orthodontists. We recently were told that we will receive a grant from the Ford Foundation. With funds from that grant, we plan to construct a series of films for teaching purposes. Dr. Lester Burket, Dean of the University of Pennsylvania School of Dentistry, has consented to become chairman of the advisory committee in this effort.)

CONCLUSION

Another aid to diagnosis and treatment planning has been described. By making it possible to see that which heretofore was more or less a matter of conjecture, this may well mark a new day in this most complex problem.

We would like to give credit to Mr. F. Allan Hofmann, electronics engineer and Chief of Department in Technical Research, and Mr. Robert T. Millard, Chief of the Speech Department, for assistance in this work.

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BIOMETRIC CORRELATIONS AMONG ORGANS OF THE FACIAL PROFILE

A Possible Solution to the Present Crisis in Orthodontics

Prof. Edmondo Muzj, Rome, Italy

FOR a long time, many proficient students of orthodontic science have tried to solve the problems of this specialty, to consolidate the knowledge acquired, and to put into practice cephalometric data and concepts. Their progress has been considerable and excellent therapeutic results have been achieved but, despite the general evolution of ideas, the perfecting of methods of research, and the closer approach to such biologic principles as heredity, individual variabilities, etc., we cannot say that they were successful.

The reason for the failure lies in the important and only apparently simple fact that these scientists have not succeeded in discovering the true essence of a dysgnathy. To identify, describe, and explain an anomaly of a somatic characteristic means to compare it with and distinguish it from a normal condition of the same characteristic and this requires, first of all, the knowledge of the normal condition. Such knowledge has not been attained as yet.

Studies are not lacking on this subject. On the contrary, research concerning a normal condition is implicit in the works of many authors, even if they seem to have a different purpose. Thus, the making of plaster masks of patients by Van Loon and Case hides the final aim of getting to know the normal condition rather than understanding anomalies. This is true of any cephalometric investigation directed toward finding the nature of somatic growth or controlling transformations determined by therapy. The same could be said of investigations which compare the members of a family. It would be of little value to know that growth occurs in one direction or the other without knowing, other than by simple individual induction, which one of these directions is normal.

Where does the evident difficulty in finding the normal condition lie? This difficulty is one of which we are now much more aware because of the evolution of our knowledge, and it affects both scientific production and practical application to such an extent that a true crisis may be said to exist.

If we carefully consider the studies which have been made, we note that, although different in procedure, they all follow, either partially or totally, a wrong trend from the very basis of the problem, namely, determination of the normal somatic condition of both an organ and an apparatus according to its conventional racial typicalness.

Presidential address delivered before the 1955 congress of the European Orthodontic Society.

That is, the orthodontist has first fixed some facial characteristics of his race which are more frequent and more evident, and which can best be compared to facial characteristics of other races. Second, on the basis of the typicalness of such characteristics, he has given them the value of a normal condition. Third, in order to transfer his principle into practice, the orthodontist has taken cranial planes and lines from anthropology and, after checking the relations established by such planes and lines with craniofacial organs (with particular regard to the anatomic points where they meet in the conventional state of normality), he has stated that the abnormal organs are those in which the said relations do not occur.

Although we admit their fascinating interest, it would take too much time to go deeper into the examination of such facts which, moreover, concern our subject only as introductory observations, considering that the interest they arouse belongs to an obsolete period. I shall, therefore, limit myself to insisting briefly on some old fundamental principles and to calling attention to some scientific demonstrations.

In order to note, from the theoretical point of view, the defects of giving the value of a normal condition to the somatic characteristics chosen in accordance with the previously mentioned observations, it will suffice to consider that its basic data are totally conventional, as:

1. The various somatic differentiating characteristics chosen are not exclusively typical of one race, but also belong to other races.
2. They are not a requisite of a race, even though they may be more or less frequent, at least for a determined quantity.
3. They do not reflect a somatic condition common to all the members of a race.
4. The racial typicalness is determined in anthropology, based not on the various characteristics but on modalities by which many characteristics get into combination.

Nevertheless, if the principle were used, it is obvious that the success or failure of its practical application in cephalometric measurements would depend on two fundamental conditions in which: (1) the cranial plane considered has a constant position in the head so that the position of the lines projected by them, and aimed at checking whether some given anatomic points of the craniofacial apparatus are in a normal or an abnormal position, also may be constant and (2) the facial profile is of one type only, so that its parts maintain the same relations with the cranial line destined to control its position.

Neither of the two conditions occurs.

With regard to the first one, after our investigations have pointed out a neutral zone placed in the head horizontally at the level of the spina nasalis from which, according to the various facial types, the peripheral points of the profile in the higher part depart upward and those in the inferior area depart

downward, as will be explained later, we suppose the existence of a horizontal plane topographically constant from the cranial base more or less toward the base of the nose. We also say that the planes, being near the said zone, are subject to a topographic variability more limited than the variability of the planes placed in more distant regions. However, we must affirm once again that cranial planes and lines used in orthodontics following the principles of racial conventional typicalness are used for aims differing from those given them in anthropology and are all subject to changes of position, thus becoming useless for measurements. For instance, if the Frankfort plane is subject to upward and downward deflections, the line projected by it perpendicularly to nasion will have an identical displacement, withdrawing from or approaching the chin, the normal or abnormal position of which cannot be fixed any longer (Fig. 1).

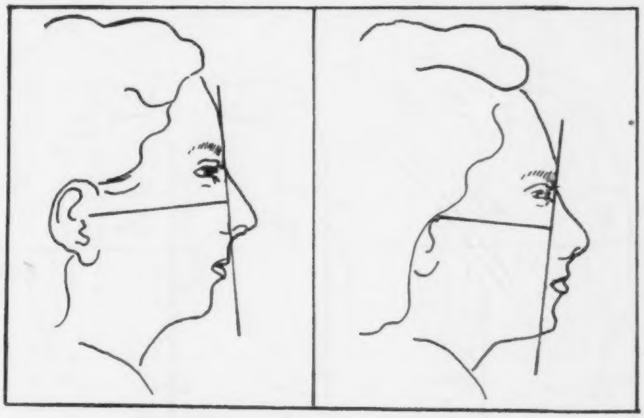


Fig. 1.—The perpendicular line from point nasion to the plane of Frankfort moves forward and backward, according to the plane's variations, and loses relation with other facial anatomic points, of which it can indicate neither normal nor abnormal states. (From Muzj: D. Record, No. 6, 1949.)

The second point makes the same condition even more striking. In fact, not considering the aforementioned defect, it should be necessary that the anatomic points always bear the same topographic relations established with measurement planes and lines so that their positions may be observed. However, after we have demonstrated that there are many types of profile, according to the position of the two lines forming them along more or less open angles, the anatomic points vary their anteroposterior position in the normal condition. In order to make the concept clearer, let us go back to the previous example. The line projected to nasion from the Frankfort plane runs along the various normal anatomic points when the profile is rectilinear or has a minimal angularity. On the other hand, the line is more and more distant from the said points, as well as from gnathion, the more the profile becomes angular though remaining normal (Fig. 2).

It does not seem necessary to insist that we can ignore the percentage of cases in which the said line of measurement keeps the wanted relations with the anatomic points of which it could indicate a conventional normality of

position, in comparison with the broad percentage of cases where it would wrongly indicate a backward position. Such a percentage does not justify the application of the line.

In order to close my statement with a general conception reflecting the present situation from a synthetic point of view, I shall say that all these measurements do not lead to any significant result. It therefore follows that these measurements, while unable to perform the task of fixing the normal morphotopographic characteristics of the facial-dental-maxillary apparatus or of distinguishing between them and the anomalies, can be of no help to the specialist for the statement of the principle whereon they are based, that is, the reason why they are believed capable of fixing normality and thus distinguishing the anomalies. This acknowledgment prevents the specialist from the possibility of any inductive work which requires the categorical and strict application of the measurement beyond discussion.

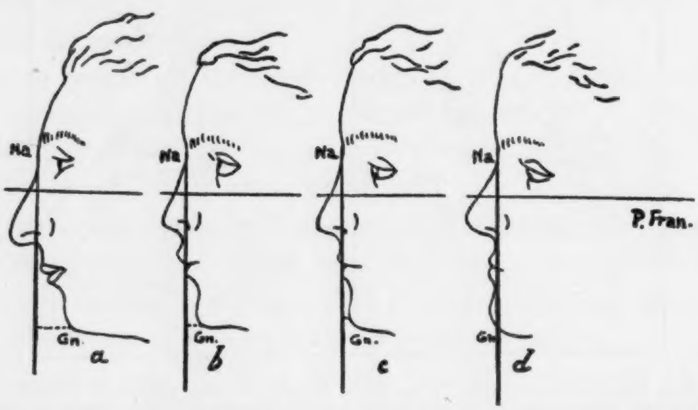


Fig. 2.—The perpendicular line from point nasion to the plane of Frankfort touches points which are different according to the various types of profile, and therefore leads to diagnostic errors.

The simplicity and conciseness that I have used must not be misjudged as representing an intention to undervalue the complex scientific meaning and the importance of methods of anthropologic measurement which have been deeply studied for many years. The simplicity is due to the aim of trying to reach a clear and rapid understanding of facts which, if examined differently, would require a discussion far wider than is needed here to reach our conclusions. At this point I shall merely repeat that although orthodontists heretofore have applied many methods of measurement and have found many personal combinations among cranial planes, lines, and points called methods of diagnosis, they have not been successful in finding the necessary rule for determining the normal and abnormal conditions and a consequent practical mean capable of tracing sure diagnosis independent of their optional opinions and of explaining, even if partially, its mechanism of formation.

In fact, the normal condition is not a state to be determined through fantasy or convention; rather, it is a fact responding to a natural law of

universal order. It can therefore be determined only if we possess this law. We may think that we are now facing a difficulty which cannot be overcome, confronted as we are with a condition of such general order, even if the rule were simply expressed by saying that the *normal condition is nothing but a state of proportion existing in the organs and their functions.* The way to reach this knowledge is not so difficult if we join Quetelet's determination of the normal average man. In about 1837 this scientist studied men in the light of a statistical methodology, different from the mathematical one, and illustrated

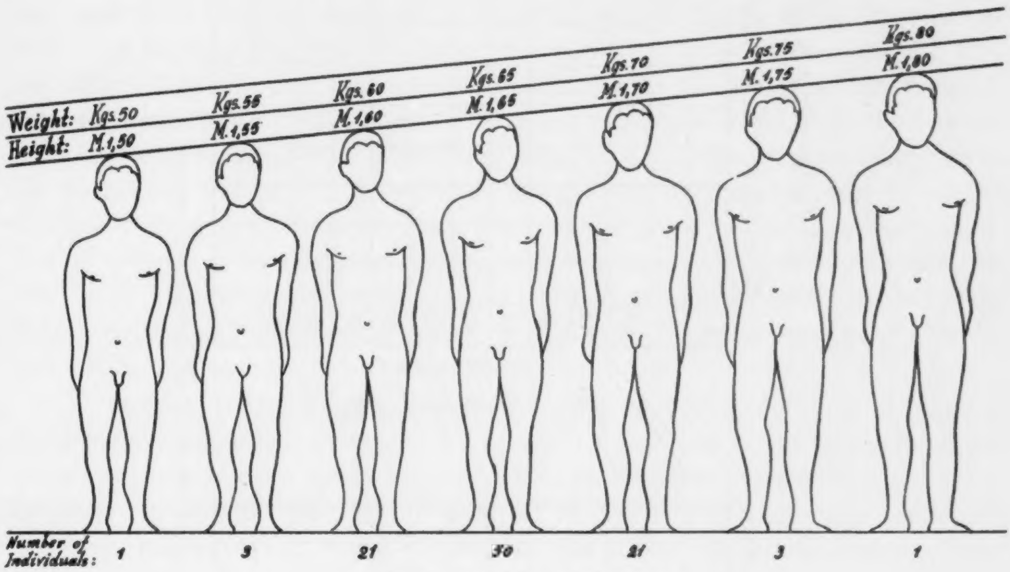


Fig. 3.—Somatic correlations.

some natural facts of fundamental importance in solving our problem. They are briefly pointed out hereafter and are accompanied by simplified examples, therefore not pertaining to research methods of perfection.

1. *In each series there are some frequently recurring values which constitute the serial average or mode.* For example, in examining a group of 100 25-year-old men, we notice that fifty of them measure about 1.65 M. while the other fifty have different heights which run from a minimum of 1.50 M. to a maximum of 1.80 M. The height of 1.65 M. represents the *average* value for that series of persons. The heights of 1.50 M. and 1.80 M. represent the *extreme* values. These heights, which differ from the average, are *variations* (principle of variations) (Fig. 3).

2. *The frequency of values decreases in a symmetric way—passing from the average to the inferior and superior values, and so much more so as it approaches the extreme values.* For example, the number of persons measuring over or under 1.65 M. gradually decreases until such persons become perhaps the only specimens. Thus, out of 100

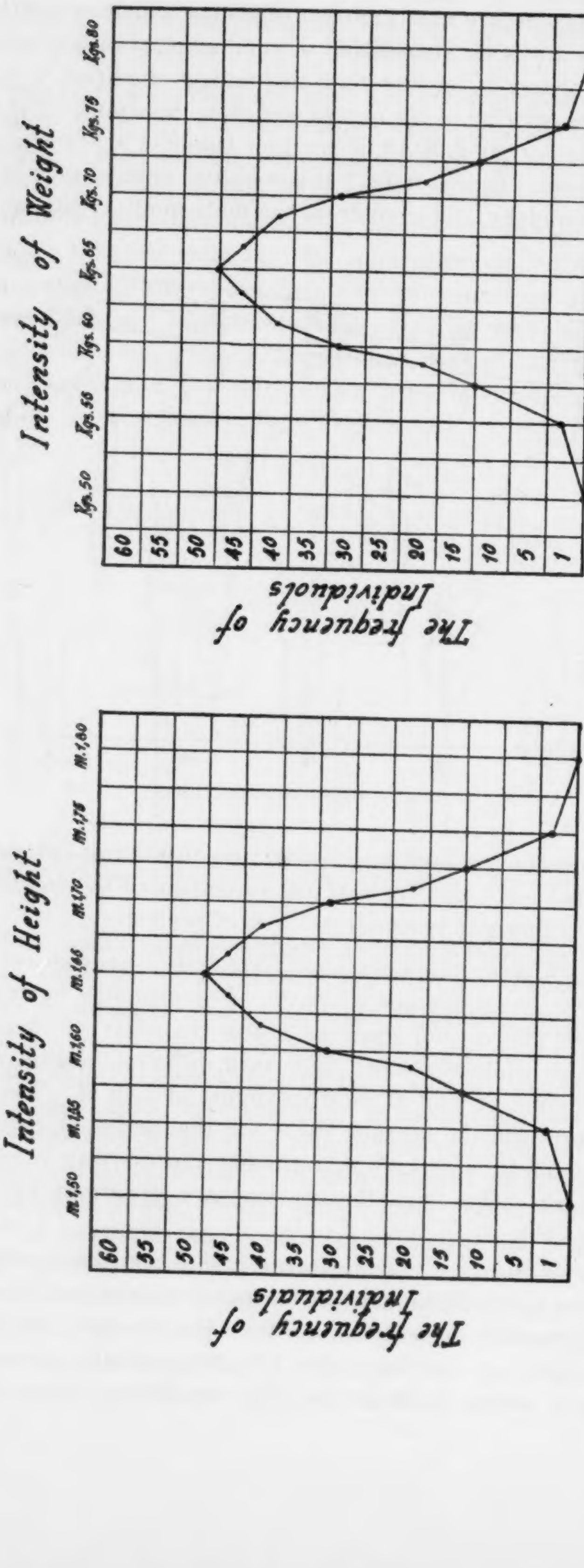


Fig. 4.—Binomial curves built on somatic correlations.

> men, we have fifty who are 1.65 M. tall, one who is 1.50 M. tall, and one who is 1.80 M. tall. There may be only two or three whose height approaches 1.50 M. and 1.80 M.

If a polygon of frequency is constructed on a double-entry table, with the number of subjects disposed according to ordinates and values according to abscissas, we obtain a bell-shaped configuration known as the *binomial curve* (Fig. 4, *A*). Further, we note that the above behavior (of which we have given height as an example) is repeated in a great number of characteristics, thus disclosing the existence of a concatenation among them (correlation law). If we examine the weight of the same 100 25-year-old men, we find that fifty of them have a weight of 65 Kg., while the others weigh from an extreme maximum of 80 Kg. to an extreme minimum of 50 Kg. The variations of these weights take place according to a polygon of frequency, as in the variations of height. If we examine the size of the shoulders or of the thoracic perimeter of each of these 100 persons, we will find a similar result. A comparison of the different polygons of frequency clearly shows that all the above characteristics converge, as much for their intensity as for their frequency, toward the same average, disclosing a consistent system of correlation (Fig. 4, *A* and *B*).

In such a complex of facts, from which the binomial law of natural phenomena originates, there can be found the solution of the problem of the discovery of a normal condition, inasmuch as Quetelet deemed that the average man represents "the organic result of the various average elements joined together, which nature would accomplish were it not for the influence of disturbing factors." Quetelet followed this statement with a long discussion concerning the value to be ascribed to the average man and to the correlation among characteristics. It would not be constructive for the orthodontists to retrace the paths of other scientists for the mere purpose of making criticisms. In our opinion, it would be useless to waste years in a discussion of the same arguments only to arrive at last at the conclusions reached by those in other branches of science. In fact, the doctrine of the average man was rapidly applied with surprising results in all fields of biology. Researches were made, usually by means of Quetelet's statistical methodology, as Castaldi points out when he says that "in the disorder of certain phenomena statistics have permitted and permit the finding of regular and fixed recurrences which would otherwise be unknown." Martinet says: "The concept of measure governs the evolution of every science and the value of statistics is great since it allows a scientific rather than banal knowledge of phenomena." If we are not satisfied with personal opinions, we can find scientific demonstrations eliminating all doubts. In this connection, it is sufficient to cite two of them. The first is Viola's. By measuring the various anthropologic characteristics of many individuals, he found that "such characteristics proved susceptible of being subjected to so perfect a variation that only very few measurements were not affected thereby." Another, and not less important, demonstration

is that of Cini. Opposing the strongest criticism that "the arithmetical average of heights is not compatible with the arithmetical average of weights," he stresses that "the relation between the variations of weights is practically constant; that is to say, the former is proportionate to the latter whenever a large amount of data is considered. And since the same proportion exists between the averages of the numerous couples of human characteristics, it consistently follows that the ideal individual with respect to all his quantitative attributes is the average individual."

There is no doubt that when the greatest number of characteristics is proportionate, the ensuing average man may be identified with the highest expression of health and esthetics. This type of man, who impresses us with the beauty of his features, the soundness of his organs, and the reposing harmony of his appearance, is not an abstraction born from the imagination of an artist endowed with particular sensibility and experience in the search for beauty refined through centuries, but is, on the contrary, a concrete fact since he is constituted of mensurable characteristics demonstratively regulated by a biometric correlation among somatic characteristics.

No one can maintain that such a human type is not normal, but we must not make the mistake of believing that it is the only normal type. In fact, the proportional confluence of characteristics toward the common average, which could be defined as a superlative normality, does not always occur inasmuch as characteristics have two other manners of converging proportionally. One of these differs from the average because of a greater or lesser amount of characteristics, as can be noted in observing graphs of correlations among more couples of characteristics. As a simple example, let us consider the same polygons of frequency (Fig. 4). We observe that this correlation happens not only in the case of the average, but also in every case of deviation from it; for every variation, there is a corresponding variation of the other characteristics of an identical frequency and intensity. In fact, if the variation of 65 Kg. in the characteristic weight corresponds to the variation of 1.65 M. in the characteristic height, the variations of 50 Kg. and 80 Kg. correspond respectively to the variations of 1.50 M. and 1.80 M. of the characteristic height, and so on for all intermediate characteristics. Therefore, we can presume that all variations which differ from the average and are enclosed in a binomial curve are normal, because they have the same correlation among characteristics which the average has, notwithstanding changes in the intensity of characteristics. Since a biometric correlation always exists, if the proportional average confluence is normal, so are the others, even though the degree of perfection decreases as we proceed toward the extreme values; they are relatively normal, although they displease our esthetic sense in the case of the dwarf and the giant.

The other proportional confluence of characteristics is less perfect. In addition to the somatic variations just discussed, which may be defined as variations of a correlation that remain mathematically perfect despite the

changing of the intensity of characteristics, we have other less fortunate variations. As the extreme variability of Nature creates the somatic characteristics, these frequently approach the proportional values approximately, thus giving rise to divergencies which are considered as errors of Nature.

It often happens, for instance, that a person of a given height does not have a perfectly corresponding weight, but is a little heavy, so that his weight exceeds his height; or he is a little light, so that his height exceeds his weight. However, these divergencies are usually contained within narrow limits, while the organs subject to them nevertheless attempt to reach a correlation of adaptation with the other organs, so that the correct functions of the organism and its esthetics are not compromised. Only in dependence of the excess of some characteristics relative to others is a tendency to one or the other states of suffering more likely. The persons subject to these divergencies are therefore to be considered normal. And, since divergencies are systematically repeated, it has been possible to classify the persons in whom they occur as *constitutional types* (constitutional biotypology).

Therefore, both the cases considered above demonstrate that the average human type is not the only normal type and that there are many normal types. This is of the greatest importance for us, because what happens to the individual as a whole happens to each part of his organic apparatus, so that the normal condition of each apparatus rests in correlation among its parts.

From this, it clearly appears that the most important phenomenon is constituted by a correlation which causes the sizes of the organs to vary proportionally; and it is obvious that the great utility of the statistical methodology lies in the classification of somatic variations which, in the end, constitute types with the same proportional relationships as the average (and likewise normal) type. Thus, when we speak of statistical variation, we mean a classification of facial types rather than research for an average or standard type.

In view of the foregoing, I believe that we can draw the following conclusions:

1. *Somatic differences exist in each apparatus or organ from individual to individual.* (Thus, the height of a man may vary from dwarf to giant.)

2. *Somatic variations do not occur separately and unproportionally, but simultaneously in more apparatus or organs, following an identical rhythm, so that a proportional state is preserved among them.* (That is, if the length of the trunk increases, so does the length of the lower limbs, and if a person's total height grows, so does his weight.)

3. *Rhythmical or proportional variations represent many normal conditions since they correspond to perfect, or at least correct, functions and esthetic postures, so that the individuals and their apparatus or organs appear under not only one aspect, but many normal aspects*

which indicate different morphologic types. (For example, apart from other necessary correlations, all men of different height whose weight and thoracic perimeter are proportional to their height, as well as the length of their limbs to the length of their trunk, are normal.)

NORMALITY MUST ALWAYS BE FOUND IN A CORRELATION AMONG FACIAL CHARACTERISTICS

It is sufficiently demonstrated that the state of normality is expressed only by a rhythm of correlation among many organs, which thus become

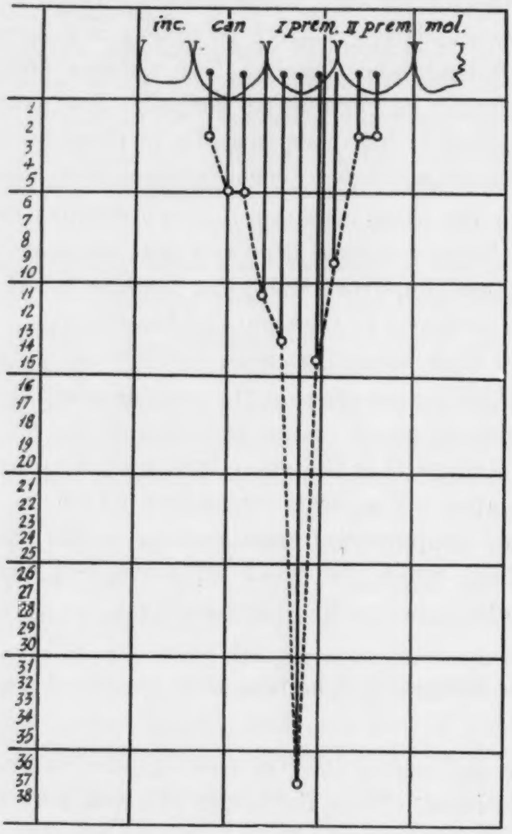


Fig. 5.—Simon's orbito-canine correlation. (From Muzj: *La Stomatologia,* 1928.)

mutually proportional with respect to both functional and esthetic requirements. Therefore, we feel that if the binomial law of natural phenomena or, in practice, the statistical methodology allows the identification of constitutional types, it is absurd to believe that this same methodology proves useless in the examination of the face and that it cannot therefore be useful both for seeking in the face that correlation which distinguishes the different normal types and for determining a disproportion or abnormality. The only problem, then, is to find a proper correlation in the head.

Orthodontists long studied the correlations between the facial-dental-maxillary apparatus and body, following different classifications. An important study is that developed by De Nevrezé, who distinguished the various dentofacial morphologic types following the classification of the French homeopathic school based on the mineral metabolism of tissues.

The first attempt to apply statistical methodology was made by Paul Simon, who perceived with intuitive genius that only the statistical methodology created by Quetelet could permit the identification of a normal condition and the distinction of anomalies. The procedure adopted by him was as follows (Fig. 5): He selected the Frankfort plane as a cranial plane of reference and the cusp of the upper canine as the reference point. On the basis of serial statistics on the anteroposterior position occupied by the cusp of the canine in

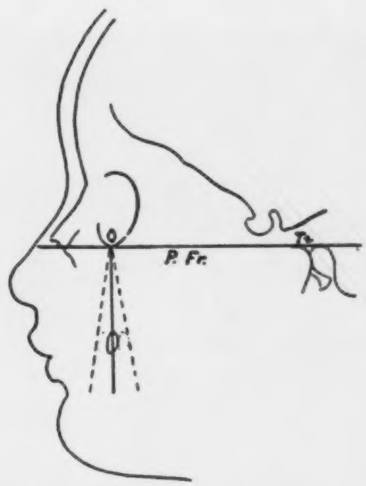


Fig. 6.—Variability of the statistical relation between the canine and the plane of Frankfort.

relation to the Frankfort plane, he drew a binomial curve and found that its position varied forward to backward, within a large area of fluctuation and with a great frequency (or average), in relation to a line or another plane perpendicular to the first in the orbital point (Fig. 6). Passing to the most important part of the operation—the interpretation of these data—Simon assumed that the average, or the position occupied by the cusp of the canine in relation to the orbital plane, was a normal position and its variations were anomalies. Then, putting this interpretation into practice, he established that every time the canine occupies an anterior position with respect to the orbital plane, it must be brought to it, and conversely if it is in a posterior position.

The well-known failure of this procedure is mainly attributable to such interpretation, and thus it must be considered as retracing our steps from the fundamental principles on the basis of which statistical methodology was introduced in constitutional medicine. One of these principles states that a normal condition occurs when different characteristics or organs are mutually

correlated so that an esthetic and functional optimum is preserved (that is, there is a normal condition when height and weight are correlated or proportionate according to the binomial law of natural phenomena). Therefore, it is necessary to take into consideration at least two organs or two characteristics whose correlation is certain. The procedure followed by Simon considers only the canine, since the Frankfort plane plays solely the role of an anthropometric reference conventionally considered as stable. Thus, there is lacking the main presupposition of the existence of that organic correlation which is the only element that makes possible the determination of a normal condition and the distinction of the anomalies, while it disregards all the other organs and particularly those above the Frankfort plane. Due to the lack of one or more organs which should constitute a correlation, another fundamental principle is broken—that is, the principle that other characteristics

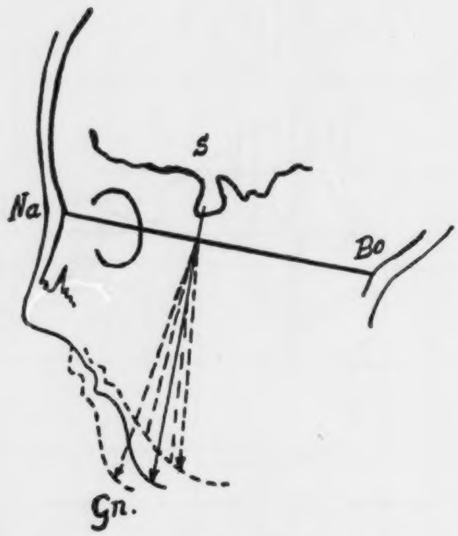


Fig. 7.—Variability of the statistical relation between the chin and the nasion-Bolton plane.

(or variations) included in a binomial curve are normal—inasmuch as this normality of variations can exist only if there are other characteristics related to them with the same proportionality (correlation). In fact, since Simon (who certainly occupies one of the first places among the pioneers of orthodontics and is not criticized here) did not make a mistake but was unaware of a fault connected with the scientific evolution of that time, he was constrained, because of the lack of such questioned correlation of the canine with other organs, to consider as normal only the average position of the canine (namely, that corresponding to the orbital plane) and to consider as an anomaly any departure from it, suggesting the above-mentioned correction and thus standardizing the therapeutics toward one type of face only.

Furthermore, it cannot be overlooked that the situation was made worse by the presence of another indeterminate fault represented by the Frankfort plane's instability and variability transmitted to the orbital plane and, consequently, to the canine.

I have preferred to take this procedure as an example both as a matter of justice, since it represents the original attempt made by Simon to apply the statistical methodology in orthodontics, and because this procedure reflects exactly the failure which other similar procedures met subsequently, even though the Frankfort plane was replaced by another plane, such as the nasion-Bolton, and the cusp of the canine by other points, such as gnathion (Fig. 7).

FULL APPLICATION OF STATISTICAL METHODOLOGY BY MEANS OF A SOMATIC CORRELATION DETERMINED ON THE BASIS OF MUZJ'S FRONTAL-FACIAL ANGLE (CORRESPONDENCE WITH THE BINOMIAL LAW OF NATURAL PHENOMENA)

Because of the obviousness of these faults, pointed out since 1931 in our official report at the congress of the International Dental Association in Paris, we thought some years ago that the problem could be solved by keeping to

Fig. 8.—Correlation between the parts of the profile, upper and lower, to the subnasal point and Muzj's fronto-facial angle.

the binomial law of natural phenomena and giving the somatic variations a very different, as well as exact, interpretation. Thus, we passed to a second method of applying the statistical methodology in orthodontics, choosing a procedure which differs from the one set forth above. Always bearing in mind that a normal condition is expressed by a somatic correlation among more organs and that somatic variations, when correlated, are to be considered as normal characteristics, we sought in the head such a correlation among other organs; we sought not only a general correlation as the one which may exist between size and form of the teeth, size of arcade and facial indices, but a specific correlation localized in the facial profile, valid for the whole head and acting in an anteroposterior direction where orthodontic investigation is most frequently directed.

I discovered a correlation which possesses the above-mentioned requisites, after I had overcome the main obstacle of finding, by mere intuition, at least two somatic characteristics of the head showing a simple correlation from which to determine a more complex correlation extended to other organs of the head and the body.

The original or simple correlation to which I refer and, in any event, the most important because it is determinant, is constituted by two organs of the facial profile, namely, the upper and lower parts of the profile. These are marked, respectively, by two lines which, starting from the subnasal point, go upward to the frontal point and downward to gnathion and form an angle that we request should be called "Muzj's frontal-facial angle" (Fig. 8).

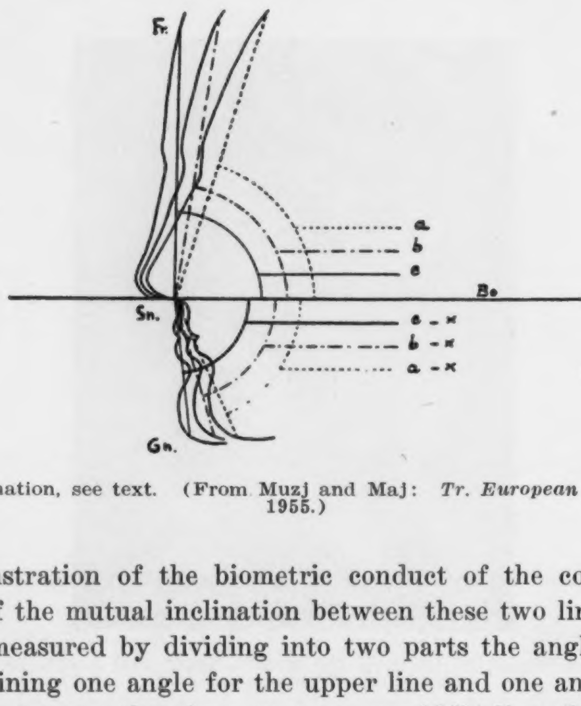


Fig. 9.—For explanation, see text. (From Muzj and Maj: *Tr. European Orthodontic Society*, 1955.)

The demonstration of the biometric conduct of the correlation needed measurement of the mutual inclination between these two lines; such inclination could be measured by dividing into two parts the angle formed by the lines, thus obtaining one angle for the upper line and one angle for the lower line. It was necessary, therefore, to trace a middle line (horizontal plane). This one, which had to be anatomic, was chosen by us in plane *BO.Sn.* which was proved by subsequent researches to be of a very limited variability. We must observe that point *Fr.* is more distant from middle point *Sn.* than point *Gn.*; the two angles have not the same width, but the lower of a number of grades in minus which can be determined in every population (Fig. 9).

As we were now capable of measuring the angle formed by the two lines, upper and lower, it was possible to conduct the investigation through the statistical methodology. Having traced the binomial curve on the basis of statistical data, we found that when the lower line inclines backward or straightens forward, the upper line also inclines or straightens proportionally.

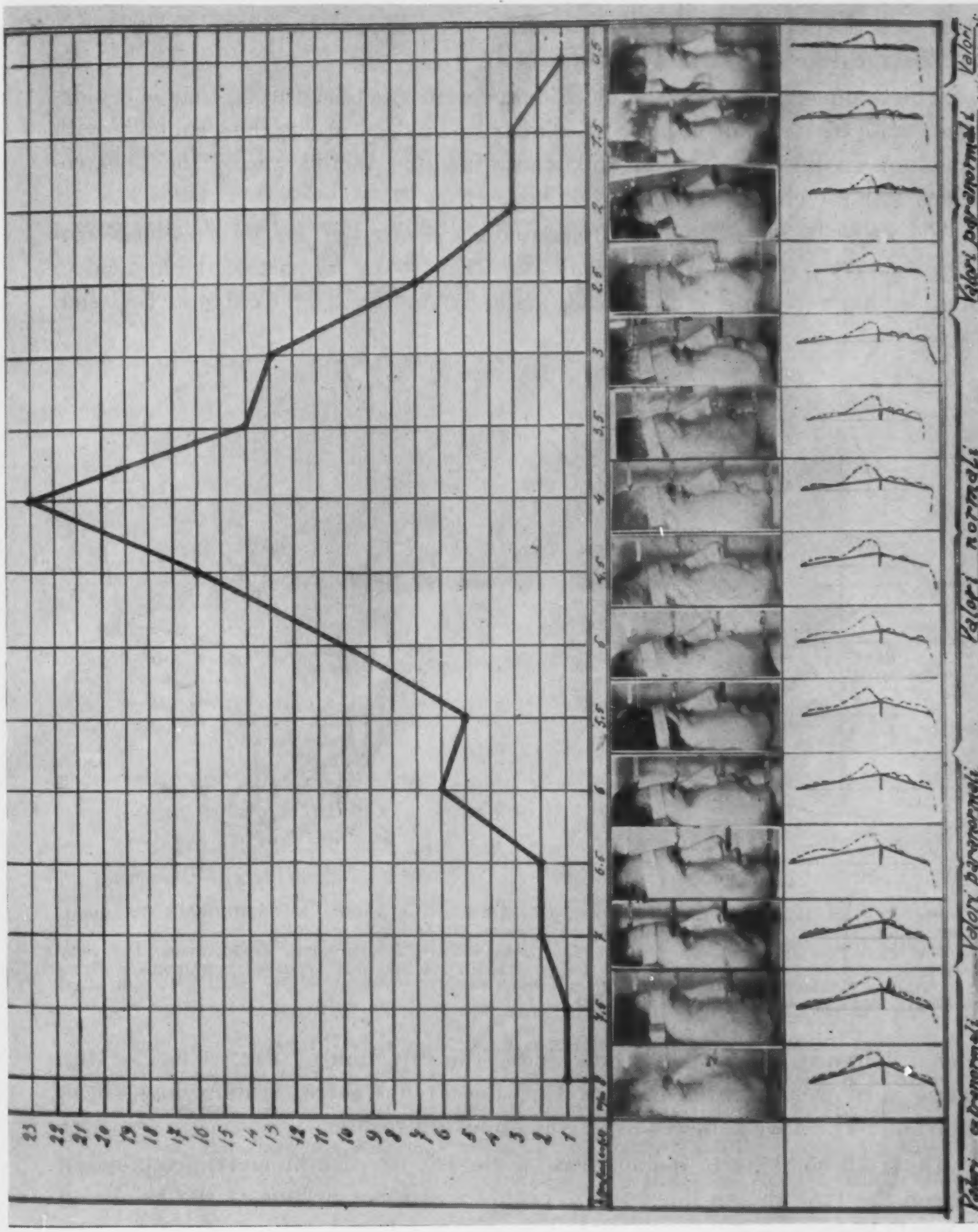


Fig. 10.—Conduct of Muzj's correlation according to the law of natural phenomena. (From Muzj: D. Record, No. 6, 1949.)

The two lines, therefore, form two variables with biunivocal dependence and we can write:

$$a = b - x$$

where a is the width of the upper angle, b the width of the lower angle, and x the constant difference in minus of the latter.

This happens, moreover, in accordance with Quetelet's laws, that is, by degrees whose extremes of greater or smaller inclination of the lines coincide with the minor frequency of cases, and whose medium inclination of the lines coincides with the greatest frequency of cases (Fig. 10).

Scientific Demonstration of Biometric Correlation of Muzj's Frontal-Facial Angle and Its Extension to the Head and Trunk.—In support of the method to which we are referring, studies were made by the Research Centre of Bologna,

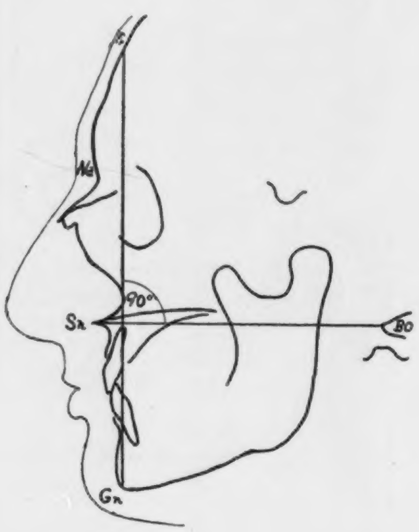


Fig. 11.

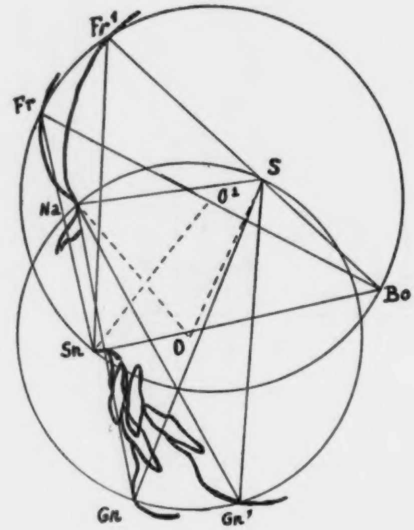


Fig. 12.

Fig. 11.—Sn.-Bo. plane forms 90° angles with the line joining Fr. point with Gn. point. (From Muzj, Maj, Luzj, and Miotti: *Tr. European Orthodontic Society*, 1952.)

Fig. 12.—The figure shows that profile parts do not follow curve trajectories, but only stress the various situations of *Fr.* and *Gn.* points in the various types of profile as well as the omothetic displacement of the said points backward in relation to *Sn.* point. (From Muzj and Maj: *Schwei., Monatschr. Zahnh.* H.12, 1951.)

which I founded and which is now under the direction of Prof. Giorgio Maj, a man of powerful intellect. In this Research Centre, studies have been carried out which we believe have given enduring results.

These all combine to demonstrate the existence of a biometric connection between the two known lines of the profile and other organs of the head and the whole body, namely:

1. In one of the first studies, in fact, we can see that the line that joins the two frontal and gnathion points forms two 90 degree angles with a plane that passes between the subnasal and Bolton points, with

very limited variations despite the changing of the angularity in the profile (Fig. 11). This need not surprise us if we bear in mind that such a point is in the median part of the head where somatic variations occur less frequently, precisely reminding us that the two points keep a mutual, constant, morphotopographic relation.

2. The frontal point and gnathion deviate along the lines of the facial angle from the median subnasal point as soon as we pass from a profile of less angularity to a profile of greater angularity.

3. The frontal point moves along a segment of the circle that passes through the endocranial subnasal line and the Bolton line. The gnathion point moves along a segment of the circle that passes through the nasion and sella turcica endocranial line (Fig. 12). These

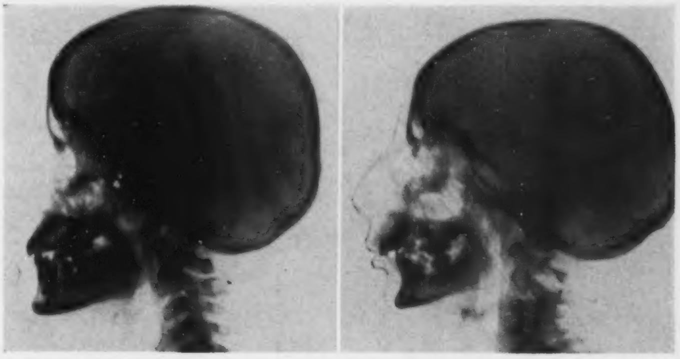


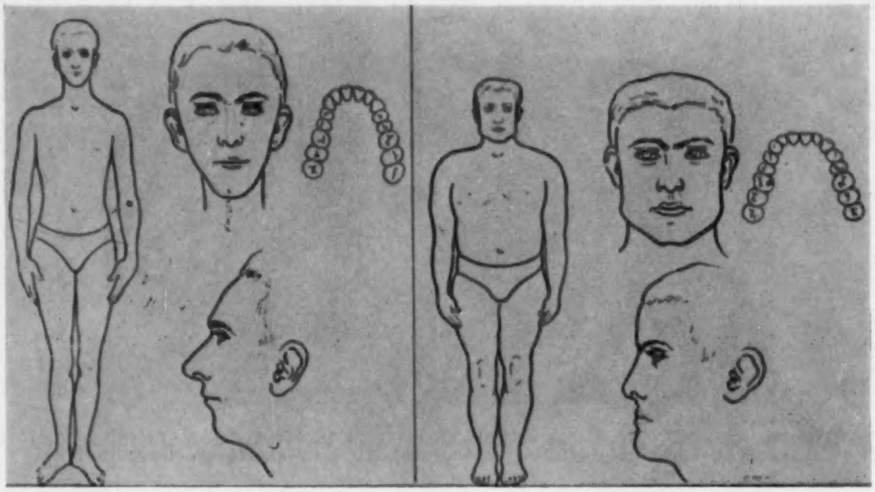
Fig. 13.—Varying posture of cervical column in relation to the types of facial profile. (From Muzj, Maj, Luzj, and Miotti: *Tr. European Orthodontic Society*, 1952.)

data also confirm the previous observation concerning somatic behavior between internal organs and the line of the profile. Since these trajectories, which spread from the cranial base toward the profile, are correlated with the preceding two biometric characteristics, they become biometric characteristics themselves and enter into the dependent variations. They gradually increase the importance of this known correlation, as they prove that the variations of peripheral parts are correlated with the variations of endocranial parts or, to be more exact, they prove that a relationship exists between the cranial base and the behavior of the profile, so that a certain variation of the cranial base corresponds to an equivalent variation of the line of the profile.

4. As soon as we pass from a rectilinear profile to an angular profile, the almost vertical cervical column takes a twisted conformation (Fig. 13).

5. A strict relationship exists between the conformation of the head, characterized by the rectilinear and angular profiles, and the body constitution (Fig. 14). In fact, after dividing the subjects into the different constitutional types and classifying the profile angle, we

examined on a double-entry table the distribution of the two characteristics with respect to each other. This proved that there is an evident correlation between the angularity of the profile and the general somatic constitution. In fact, while the normal type is indifferently accompanied with any type of profile, including the extremes, the longilinear type the great majority of cases presents in a remarkably angular profile, and the brevilinear type, on the contrary, presents a tendentially rectilinear profile. The finding of a tendentially rectilinear profile in the longilinear type, as well as a remarkably angular profile in a brevilinear type, must be considered absolutely exceptional.



A. B.

Fig. 14.—Relations between individual constitution and type of facial profile. *A*, Longtitype; *B*, brachytype. (From Muzj, Maj, Luzj, Adorni Braccesi, Lucchese, and Miotti: *Tr. European Orthodontic Society*, 1954.)

In conclusion, it is a complex of correlated normal biometric characteristics sufficient to establish a somatic correlation which may constitute the start toward the solution of both the diagnostic and etiopathogenic problems.

THEORETICAL AND PRACTICAL REQUIREMENTS OF THE CORRELATION OF FRONTAL-FACIAL ANGLE

Discovery of a Normal Characteristic in the Line of the Facial Profile.—The correlation described above permits, first of all, the discovery of a normal characteristic in the facial profile that may serve as a guide and a basis for research concerning anomalies and their etiopathogenesis.

In order to reach these conclusions, it is necessary to go back to the interpretation given to the somatic correlation when we referred to correlated characteristics, establishing that *a normal condition is expressed only by a rhythm of correlation among more organs which thus become mutually proportionate for the purpose of both the functional and esthetic optima.*

Such a normal condition is represented by a morphotopographic characteristic which is always present and invariable, namely, the mutual relationship of inclination which the inferior and superior lines of the profile retain even though the extent of their inclination changes when they pass from a maximum to a minimum of inclination.

Existence of More Types of Facial Profile.—Similarly, since all the variations of the frontal-facial angle are regulated by a correlation, their normal condition demonstrates that there are more types of profile which change according to the inclination degree of their frontal-facial angle (Fig. 15),

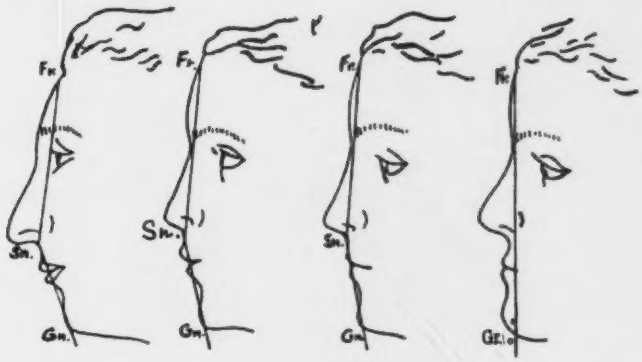
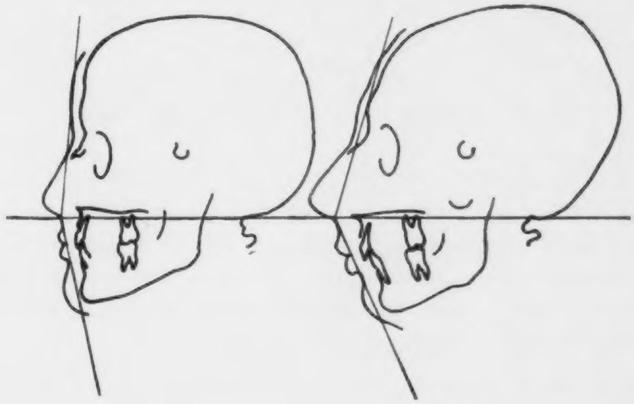


Fig. 15.—Various types of facial profile.



A. B.

Fig. 16.—Extreme types of rectilinear and angular profile. (From Muzj, Maj, Adorni Braccesi, Lucchese, Luzj, and Miotti: *Tr. European Orthodontic Society,* 1954.)

and go from a type with a strong inclination that may be defined as *angular profile* (Fig. 16, *B*) to a type with a very small inclination that may be defined as a *rectilinear* profile (Fig. 16, *A*).

THE CORRELATION OF FRONTAL-FACIAL ANGLE PERMITS DEDUCTIONS OF AN ETIOPATHOGENETIC ORDER

In order that etiopathogenetic deductions may be drawn from the abovementioned circumstances, we must go back to one of our most important

studies, namely, the one of the circles. We have seen that the frontal and gnathion points move along the segments of the circles (Fig. 17). However, we also have seen that these circles always superpose one another when passing through the same points—the nasion and sella turcica points for the inferior circle and the subnasal and Bolton points for the superior circle. This may mean that, because of such superposition, the last four points (of which two are endocranial and two are peripheral) are not individually subject to deviations as the frontal and gnathion points. Moreover, they delimit a region which holds itself morphologically compact. Now, these data clearly

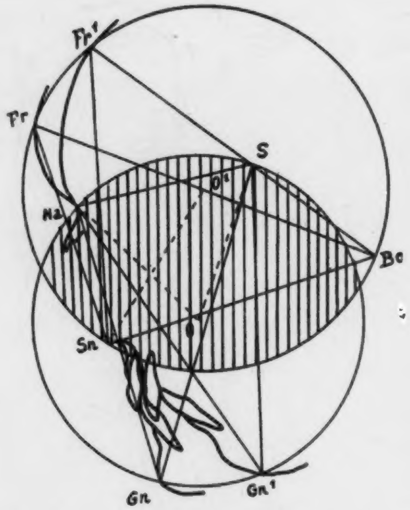


Fig. 17.—Zone of greatest stability of the head.

prove that: (1) three regions may be distinguished in the head, of which two superior and one inferior region are subject to a great variability and a medium region is less or not at all variable; (2) as the frontal and gnathion points shift backward and the subnasal point shifts forward when we pass from a rectilinear profile to an angular profile, the upper and lower regions of the head shift backward and the median forward.

It seems to me that in such an extremely important fact there is the expression of a dynamism which logically makes one think of the existence of an impulse connected with the etiology of dysgnathies. This may find confirmation in the following observations:

1. When the angularity increases, as soon as we pass from a medium characteristic to paranormal, distonormal, or extranormal characteristics, there exist the most favorable conditions for an abnormal advancement or withdrawal of the lower teeth, which gives rise to a *prosopectasia* or Class II malocclusion (Fig. 18, *a*).

2. Conversely, when the angularity decreases, as soon as we pass from a medium characteristic to paranormal, distonormal, or extranormal characteristics the most favorable conditions exist for a withdrawal

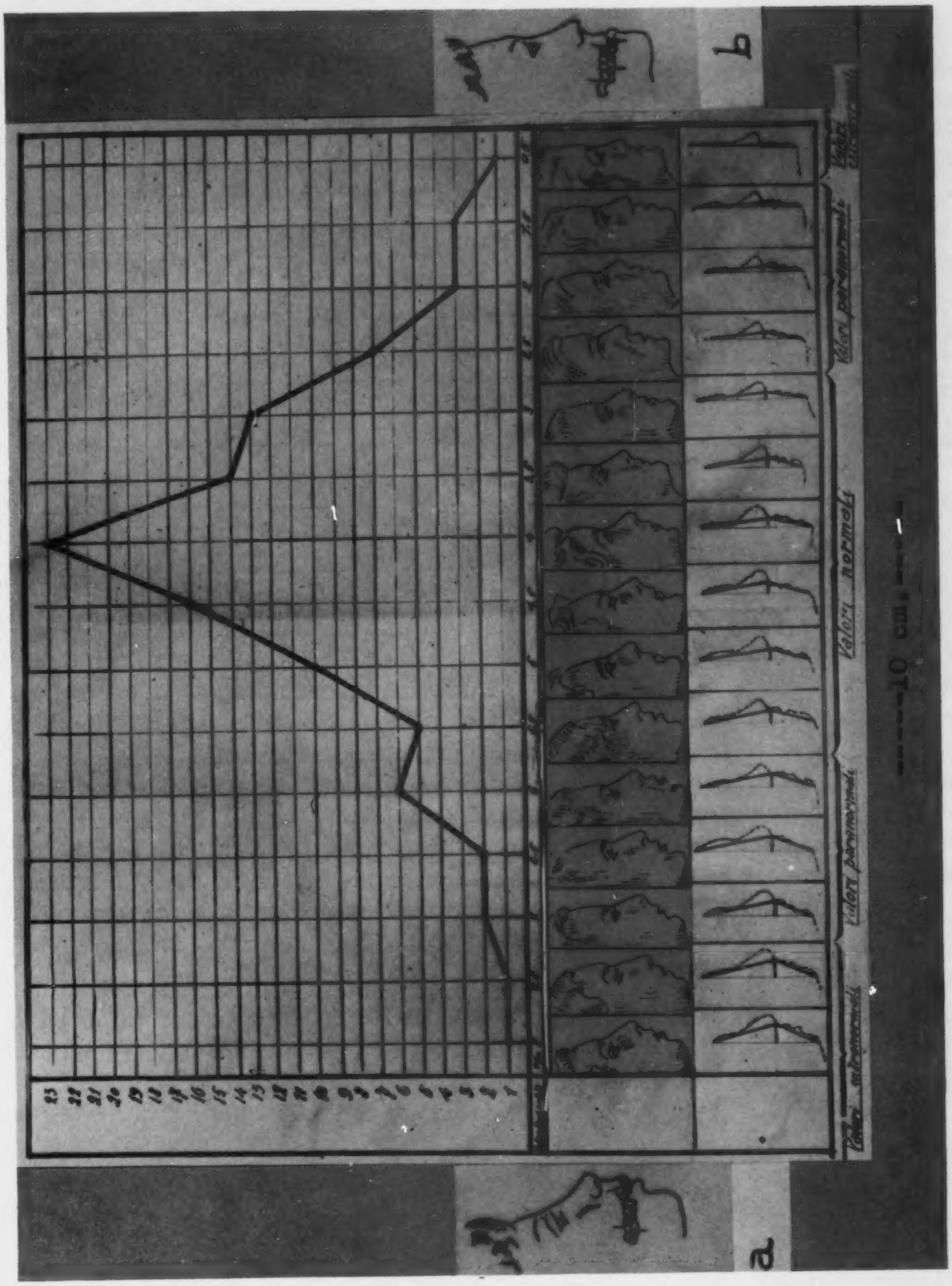


Fig. 18.—Mechanism of formation of the biggest dysgnathies. (From Muzj: *Atti Soc. progresso d. scienze,* 1951.)

of the median part of the head with retroinclination of the upper teeth and advancement of the lower part (lower lip and chin) and of the teeth, which gives rise to a *prosopentasia* or Class III malocclusion (Fig. 18, *b*).

While the above offers an explanation of the etiology of two of the principal dysgnathies and facilitates the explanation of others, it clearly demonstrates the existence of the aforesaid impulse. We cannot say much about this impulse as yet, but we can anticipate that: (1) it is endocranial; (2) it is connected with the constitutional type of the individual; (3) it has a balance center on the point of which the head rests upon the spinal column; and (4) it spreads from this point toward the three parts of the head, so that the latter *either find their balance placing themselves one upon the other on about the same anteroposterior level, in which case they give rise to a rectilinear profile, or they find their balance on a more advanced position than the middle part and more retruded than the superior and inferior parts, thus giving rise to an angular profile.*

THE CORRELATION OF FRONTAL-FACIAL ANGLE HAS A SPECIFIC VALUE

Three details clearly appear from what has been set forth: (1) a well-determined morphotopographic reference is always at the disposal of the specialist for orthodontic research (angle between two lines of a certain opening); (2) this reference is located in the most central point of the examination, or the facial profile; (3) the cephalometric data furnished by such reference concern the anteroposterior behavior of the facial morphology—the one which interests us most—because dominant deviations (anomalies) occur in this direction and, as a consequence, others take place. Therefore, it seems undeniable that the correlation of frontal-facial angle has a specific value in orthodontic research.

THE CORRELATION OF MUZJ'S FRONTAL-FACIAL ANGLE PERMITS THE DISTINCTION AND THE RECOGNITION OF FACIAL-DENTAL-MAXILLARY ANOMALIES

Knowing the correlation expressed by the formula $a = b - x$, we may easily know whether or not a normal condition exists. In fact, since the inclination of the lower line of the profile is known, if the parts of the profile which should correspond with it do not do so, this means that they are abnormally placed forward or backward to an extent which may be calculated.

It is a matter of fact that transverse deviations may be deduced from these anteroposterior deviations.

The practical application of the correlation with which we have been dealing requires a compromise—the use of a cranial plane which permits the calculation of the degree of inclination of the lower line of the profile. It is necessary to point out that this plane does not have a determinant function as in the other method, but has a rather secondary function because the inclination of the lower line depends mainly on the known inclination of the upper line rather than on the plane only.

It seemed to us that the proper plane for the calculation was the one which from subnasal point is drawn to the Bolton point, or another neighboring parallel to it (Fig. 11).

By this we do not mean that the cephalometric mensuration involved—which avails itself also of this plane—is faultless. The possibility of making an unavoidable mistake exists in any system of cephalometric mensuration. The problem is to find out the nature of such a mistake and learn how it can be checked. If the mistake results from an individual variation governed by a biometric correlation like the one of the frontal-subnasal-gnathion it is not only known, but systematically checked. Similarly, the problem is to find out the nature of the compromise that must be made. In fact, if it is positive that there are many types of facial profile and that the normal characteristic common to them is found only in a certain somatic correlation, there is no doubt that it is necessary to adopt a method of diagnostic investigation based either on the correlation of the frontal-facial angle discovered by us or on a different correlation discovered later on by one of my colleagues and which may best apply.

In such a case, since planes and cranial lines are indispensable to measurements, a compromise and the consequent inaccuracy of the measure will be unavoidable. In any event, the error on which the compromise is accepted must have two qualities. First, it must be of little value and always much smaller than the error produced by a method which uses only cranial planes conventionally considered as stable. Second, it must be fit for all types of profile and not for one type only.

PRACTICAL APPLICATION

To perform the mensuration, it is first necessary to establish the type of profile. Therefore, the frontal, subnasal, and gnathion points must be connected. The two resulting lines will form angles of different opening (angular profile) or else they will form no angle at all (rectilinear profile).

MENSURATION METHOD OF ANGULAR FRONTO-FACIAL PROFILE

1. *Investigation of the Normal Superior Line of the Frontal-Facial Angular Profile and of the Normal Subnasal Point.*—In this case, the anteroposterior position of nasion plays a very important role because it expresses the direction of the forehead in relation to the inferior parts of the profile. We have the following morphotopographic circumstances:

> A. Nasion is situated on the frontal-subnasal line; it means that this is the normal superior line of the frontal-facial angle and *the subnasal point is in a normal position* (Fig. 19, *A*).
>
> B. Nasion is situated before the frontal-subnasal line; it means that this is a curvilinear profile (subtype of the angular profile). Therefore, this is also the normal superior line of the frontal-facial angle, and also *the subnasal point is in a normal position* (Fig. 19, *B*).

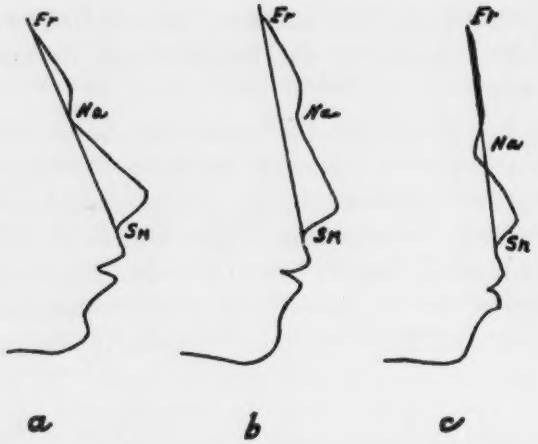


Fig. 19.—Examination of normal or abnormal position of *Sn.* point. (From Muzj: *Tr. European Orthodontic Society,* 1955.)

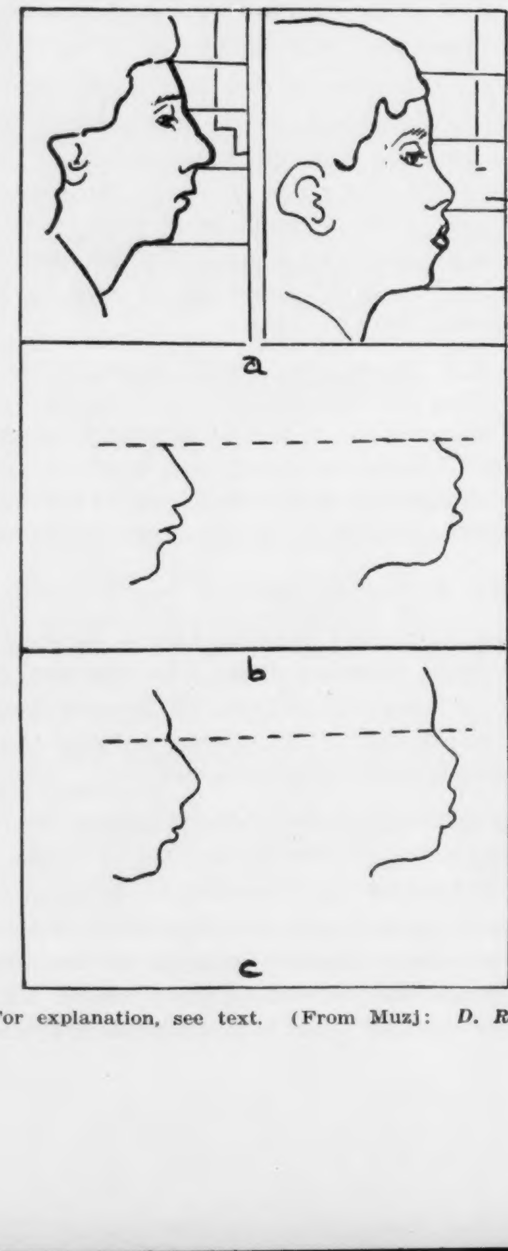


Fig. 20.—For explanation, see text. (From Muzj: *D. Record,* 1949.)

C. Nasion is situated behind the frontal-subnasal line (of course, always in the case of an angular profile) (Fig. 19, *C*). Special consideration must be given to the implications of this profile because, due to its sinuosity determined by the perpendicular forehead and the protruding jawbones, we are obliged to recognize the characteristics of the Negroid race, which are considered as abnormal in the white race although the prejudice is due to racial esthetic standards.

If we observe the way in which these characteristics are shown, we shall be convinced of the importance of the forehead when examining a profile. In fact, if we make a comparison between the two types of profiles (Fig. 20, *A*) and suppose that they are without forehead (Fig. 20, *B*), we get the impression that

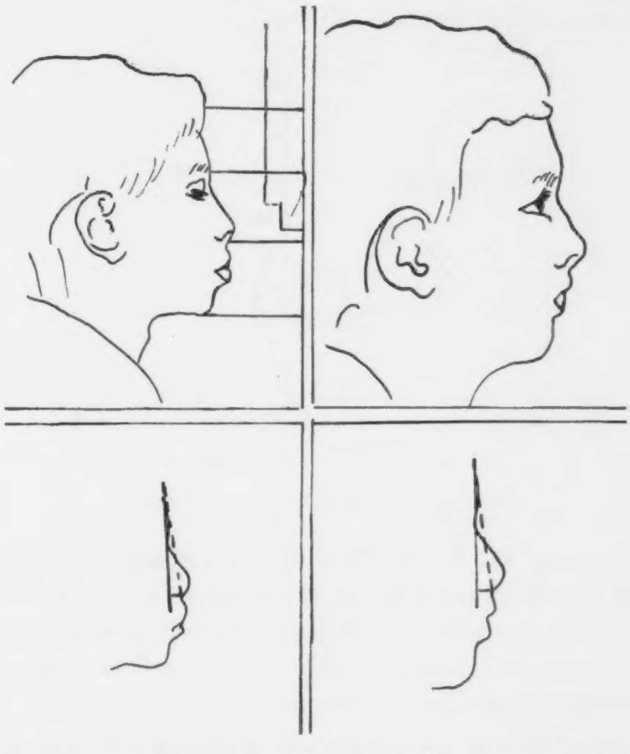


Fig. 21.—For explanation, see text. (From Muzj: *D. Record,* 1949.)

in both there is a protrusion, however, if we add the forehead, we see that the profile which has an inclined forehead has become angular and hence of the normal type. The other profile (Fig. 20, *C*) in which the forehead is perpendicular, has become the sinuous Negroid type, and hence abnormal.

It is clear, therefore, that these two types have taken on an aspect of normality or abnormality *according to the direction of the forehead.* Thus, we can conclude that not only does the forehead play an important role, but it is one of the principal elements to be considered in examining a profile, so much so as to become an element of measurement.

We must put aside the question as to whether it is possible to correct this last abnormal profile; discussions could arise over this, since the dental arches are correctly related and it would be done only for esthetic reasons. Many alterations of the profile are but the partial reproduction of this defect which is limited to the upper jawbone (Fig. 21, *B*), alteration to which is not advisable for esthetic purposes, but for hygienic ones concerning the reintegration of the masticatory, breathing, and phonetic functions. Thus, it follows that if the forehead is an element of diagnosis for the whole, it must be also for the part—that is, for the above-mentioned deviations.

Therefore, to obtain the normal superior line of the profile in this case we must draw another line from the frontal point downward, passing through nasion; then on such line, backward, we must imagine the subnasal point in order to have it in a normal position (Fig. 22).

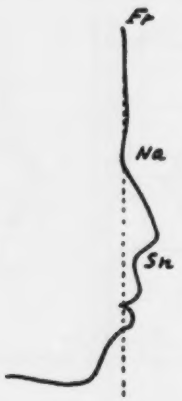


Fig. 22.—For explanation, see text.

2. ***Investigation of the Lower Line of the Frontal-Facial Profile and Examination of the Points Situated Below the Nasal Base.***—In drawing the normal lower line of the frontal-facial angle, two different methods can be followed, depending on whether one wishes to rely on the vertical frontal-gnathion line or on the horizontal subnasal Bolton plane.

First procedure: If the first procedure is chosen, which is more convenient in photographs, the triangles method should be followed (Fig. 23).

Having thus obtained the upper line of the profile, the frontal-subnasal line (starting from the direction of the forehead)—that is, the upper hypotenuse—and having the horizontal plane of the profile or base, one draws a similar triangle on the straight line which goes from the frontal line to gnathion, a distance equal to that from the frontal line to the horizontal plane, and joins to the subnasal point the extreme obtained. Thus, the lower hypotenuse has the same inclination as the upper one. Normally it cuts that part on the upper lip which is protruding relative to the lower lip and is touching both the latter and the chin.

The result of this geometric procedure is that the lower line has the same inclination as the upper line, and the difference of inclination expressed by the biometric formula is compensated by the fact that the lower line of the profile must not be reached from the gnathion point, but rather from the most anterior point of the chin.

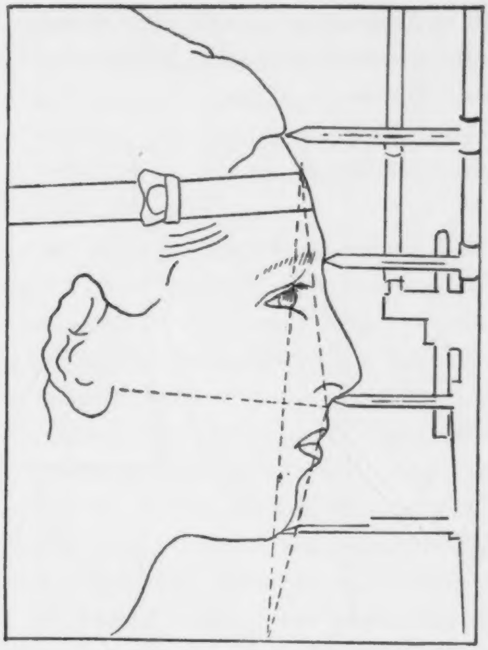


Fig. 23.—First diagnostic method of triangles. (From Muzj: *D. Record*, 1949.)

The initial error of having drawn the vertical line on the abnormal gnathion is compensated by the following situations:

A. The horizontal plane starts from a much higher level where the anteroposterior error is reduced by about two-thirds, that is, 5 to 2 mm.

B. The anterior extremity, where the error is further reduced by two-thirds or more, is used from the plane.

C. The lower line depends not only on the horizontal plane, but rather on the inclination of the upper line and on the greater length of the inferior part of the frontal-facial line, which is equal to the superior one rather than to the distance between the subnasal-Bolton plane and gnathion.

3. *Mensuration Method of Frontal-Facial Rectilinear Profiles.*—The subnasal point corresponds with the frontal-gnathion line. The angularity has disappeared and the profile is included among extranormal variations. However, a morphotopographic criterion concerning the upper line of the profile and the subnasal point depends, in this case, on whether or not the dental

arches have been affected by this extreme variation of the binomial curve. Hence, from a normal occlusion we cannot deduce the existence of an abnormal superior line of the frontal-facial profile, and all is reduced to a typical formation of the profile with an accentuated rectilinear characteristic (Fig. 24). Instead, if the dental arches have been affected and there is a wrong dental disposition, we must deduce that the profile has abnormally lost a certain angular degree which is proportional to the dental irregularity. A sketch of the normal superior line of this angularity, which can be restored with orthodontic treatment, is superfluous.

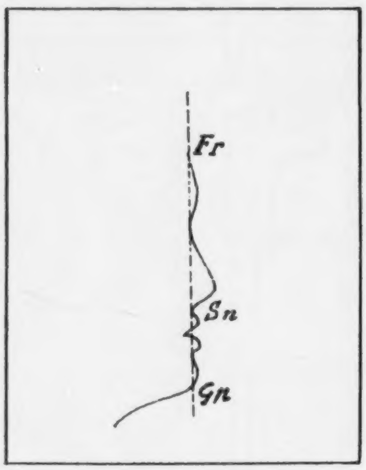


Fig. 24.

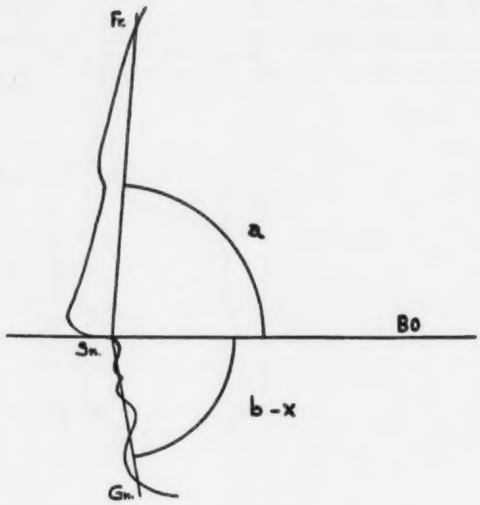


Fig. 25.

Fig. 24.—Study of rectilinear profile.
Fig. 25.—Second diagnostic method of calculation of angles.

Second procedure: If one wishes to follow the second procedure, which is especially convenient in teleradiographies, the horizontal plane should be drawn by joining the subnasal and Bolton points. Then the point where the latter meet with the upper line should be united with the gnathion point and the opening degree of the two angles should be determined. If the opening degrees of the two angles of the lower angle are the same as indicated by the formula $a = b - x$, the position of the lower line of the profile and of the gnathion point is normal. If the degrees are less, there will be a backward position of the lower line of the profile and of the gnathion point. If the degrees are more, there will be a forward position thereof (Fig. 25).

CONCLUSIVE CONSIDERATIONS AS TO THE PRACTICAL APPLICATION OF CEPHALOMETRIC MENSURATION IN ORTHODONTICS

Considering the developments over many years relating to the problem of cephalometric investigation, the obvious inference would seem to be that the orthodontist finds it very difficult to admit that because of the natural variability there can be no fixed points in the head, and that the planes and lines

drawn around them on the basis of a conventional stability are subject to their topographic variability. He also finds it difficult to admit that if he wants, nevertheless, to avail himself of the data of such conventional measurements, he must apply them accurately, as he can neither verify their accuracy nor modify them by his own induction, for nobody knows their static-dynamic function in the head. Furthermore, it would seem that he finds it difficult to admit that if he draws practical conclusions from such mensuration, in order not to leave it in the state of a useless diagnostic investigation, he jeopardizes the treatment. Any possible error, even though small, in such conclusions acquires a great practical importance since its relevance is invariably equal to or larger than the relevances of a dental deviation which does not exceed a few millimeters.

Yet, at the present stage of knowledge, the orthodontist must become convinced of this truth and be content with drawing from the cephalometric investigation indicative criteria which may help systematically his induction. However, it is necessary for the specialist to free himself from the dilemma of whether to apply a measurement without checking its accuracy or not to apply it at all. It is necessary for him to be able to understand what directions a measurement may give and to what extent it may be trusted. He can attain this understanding if he knows the morphotopographic function to which the measure corresponds in the head. We consider this knowledge possible when two conditions are present. First, he must have an idea of the static-dynamic mechanism according to which the head (and, in particular, the line of the facial profile) varies, and further know what the different types of profile are. Second, the system of mensuration must be fit for the static-dynamic behavior of the head and must follow the head's variability, that is, it must lead to a significant result. Only then will the orthodontist be able to avail himself of such indications as may be given by cephalometric mensuration, and avoid the faults entailed by its undeniable lack of accuracy.

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VIALE PARIOLI 40.

Orthodontic Profiles

FOREWORD

Various scientific journals devoted to the advancement of the specialties of medicine from time to time publish profiles of outstanding workers who contributed much to the creation and progress of their specialty. Each profile consists of a brief digest of the man's life and an outline of what he created of value of his specialty and for the public good. Many of these men have passed on; however, profiles are published sometimes of the living. In this way, every few months there is created an additional link in the chain of the record of the histories of the pioneers of their particular specialty. It has been proved that the profile section of any highly specialized journal has great reader interest and is a very popular section of the journal.

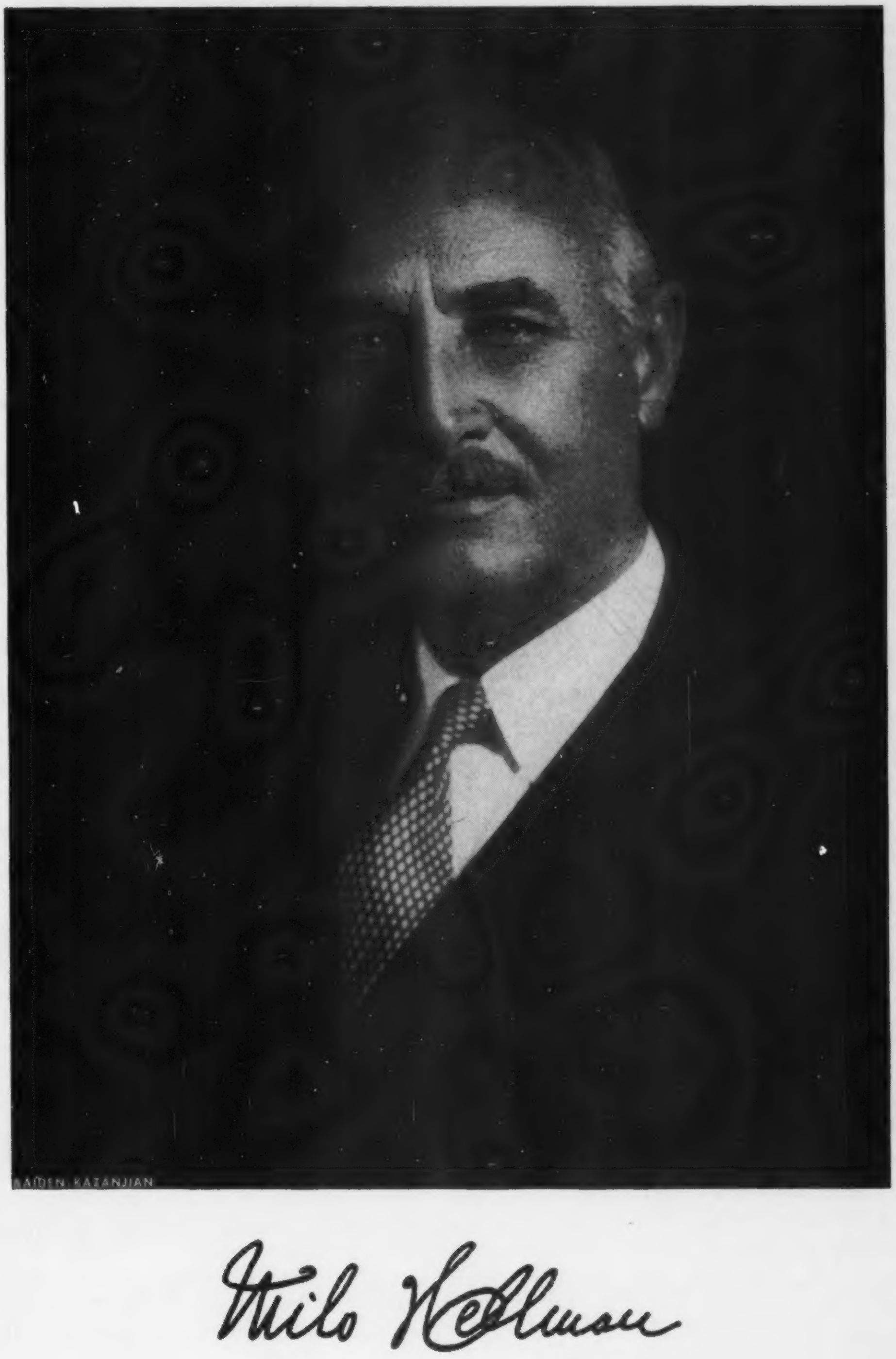
After some discussion with the Editorial Board of the AMERICAN JOURNAL OF ORTHODONTICS, it is thought that a profile section in the AMERICAN JOURNAL OF ORTHODONTICS will be of great interest to the readers. In the main, those who will be asked to write the profiles have taken a part in the development of orthodontics and know something of the life of each person presented in this new section of the JOURNAL.

The following is the first of what is hoped will be a series of profiles published from time to time. The profile of Milo Hellman was written by Bernhard Weinberger, who is the outstanding authority not only of the history of dentistry, but of the current history of the specialty of orthodontics as well.

It is with thanks and appreciation to Dr. Weinberger that the JOURNAL is now able to publish the first profile, that of Dr. Milo Hellman, one of the outstanding scientific minds who practiced orthodontics as a specialty during the first half of the present century.

MILO HELLMAN—A MAN OF SCIENCE

THE dental, and especially the orthodontic, professions lost one of its most energetic, progressive, and learned scholars on May 11, 1947, when Milo Hellman died. Born in Jassy, Romania, on March 26, 1872, he began, in his early youth, the study of the flute. Upon coming to this country at the age of 16, he became a member of the original Pittsburgh Symphony Orchestra under the direction of the late Victor Herbert. As a member of that famous orchestra, he learned that it was essential to consider every musical composition as a whole, and to study each theme or passage as a part of the whole. This far-reaching training was later to play an important part in his professional studies.



Milo Hellman

I do not know why Hellman decided to adopt a professional career, instead of becoming a professional musician. With the money he was able to save, he completed his high school education at the New York Preparatory School, and then matriculated at the Dental School of the University of Pennsylvania, graduating with honors in 1905. As an undergraduate, he belonged to the James Truman honor society, and the Epsilon chapter of Delta Sigma Delta fraternity. In 1933, his alma mater conferred upon him the degree of doctor of science.

The English historian, Gibbon, once wrote: "Every person has two educations—one he receives from others, and one more important which he gives himself." The value of imagination increases with the breadth of knowledge, and in order to understand Hellman's activities one must first know how and why he obtained the education he gave himself.

Being much older than most of his classmates and, in addition, with the help of his "magic flute," he came to know Dr. Kirk more intimately than the general run of students. He was fond of relating the many pleasant evenings spent with the Dean and Mrs. Kirk. No one who knew Dr. Kirk ever came away from a session with him without feeling uplifted, encouraged, and stimulated to better efforts and further study. Much of Hellman's early interest in science can be traced directly to his former dean's influence.

In Hellman's life one finds a remarkable unity, a unity of growth. Early in September, 1908, there came together a group of twelve men to study under Dr. Angle. For four of these it was the beginning of a new career and the making of new friendships among men who seemed to be drawn together by mutual interests. Harry E. Kelsey, John Mershon, Fred. B. Noyes, and Milo Hellman, having much in common, worked together and established a friendship that continued throughout the years. All later were to play an important part in directing the future course of orthodontics.

At the same time, while taking the Angle course, Dr. Noyes was an inspiring teacher. Beginning with the embryologic cell, Dr. Noyes carried through all development up to the tissues in a fully matured human being. His teaching helped immeasurably in directing Dr. Hellman's intellect and energies in the direction which they subsequently followed.

Another who had a lasting influence on Hellman's career was his instructor at the Angle School, Raymond C. Osburn, a distinguished student of Henry Fairfield Osborn. It was through him that Dr. Hellman started in the direction which was to bring him lasting fame. He furnished the inspiration for further study and research that brought him in personal contact with Professors Osborn, Clark Wissler, Franz Boas, William King Gregory, James Howard McGregor, and Aleš Hrdlička.

From Professor Osborn, Hellman first learned that man's skull, teeth, jaws, and face are only the present terms in an evolutionary sequence that stretches back into eons of geologic times.

From Dr. Angle, Hellman learned the concept of normal occlusion and malocclusion. He also had the advantage of being closely associated with him

as an instructor in the school and as one of the chosen few selected to experiment with the then new pin and tube appliance that Dr. Angle was then evolving and developing. This gave him greater opportunity to observe and master the Angle technique. At the same time, he was fortunate to be able to discuss, as few others could, Dr. Angle's writings. Dr. Grünberg had just translated the seventh edition of Dr. Angle's book and was anxious to learn just how closely it followed the original writing. Hellman, therefore, had the task of translating it from the German back into English.

When Hellman began to specialize, however, he refused to adopt the new appliance. Being of a conservative disposition and having previously taken Dr. Fred A. Peeso's postgraduate course in crown and bridge work, where he acquired the fundamentals of simplified dental technique plus Peeso's insistence on accuracy and precision, he refused to alter his methods every few years, as was then the custom. Instead, he continued to perfect himself in the use of appliances and techniques which had already proved their worth and, as a result, he achieved with the simpler forms of the E expansion arch complete mastery of this appliance.

Hellman was thus able to devote his time to the deeper and more fundamental problems of orthodontics. In his "Studies in Etiology," he writes: "Two groups have emanated from the Angle School. One pursued the more or less mechanistic concept of orthodontia; the other turned to the biologic approach of the subject." At that time, however, he did not feel that he was ready to delve into the mysteries of so deep a problem without a better foundation and therefore took the course in biology given by Thomas Hunt Morgan at Columbia University. Later, at the same institution, under Professor Gregory, he completed the prescribed course in vertebrate paleontology. Here we have a partial answer to the question of why Hellman thought so clearly and was able to master the many problems confronting him.

From Professor Morgan, Hellman learned at once the clarity of Mendelian principles and the complexity of their operations. From Professor Boas, he learned various effective techniques in analyzing measurements and in constructing effective diagrams. Working and studying with Professor Gregory, he obtained a thorough knowledge of vertebrate paleontology. All Hellman's studies in the field of genetics, anthropology, and evolution were originally motivated by his interest in orthodontics. He was always grateful to those who had opened the pathways which he hoped to widen and push forward. The story of his career as a scientist is found in the long array of his nearly 100 published papers.

Hellman's interest was thus broadened, and at his death he was an active member of the American Association of Mammalogists, the American Association of Physical Anthropologists, and the American Ethnological Society, and a charter member of the Society of Vertebrate Paleontology, the Society for the study of Evolution, and the Society for the Study of Child Development. He was a member of the Committee on Growth and Development, White House Conference on Child Health and Protection (1930), a member of the executive group

of committees for standardization of anthropologic technique of the International Congress of Anthropologists and Ethnologists in 1937-1938, and a Member of the South African Expedition of the American Museum of Natural History in 1938. From 1932 to 1933 he served as vice-president of the New York Academy of Sciences.

He was editor of Volume 3 of the *American Orthodontist* and on the editorial board of the *Journal of Dental Research, Archives of Clinical and Oral Pathology,* and *Bulletin of the First District Dental Society, N. Y.* He was a fellow of the New York Academy of Sciences, American Association for the Advancement of Science, the New York Academy of Dentistry, and the American College of Dentists, an honorary fellow of the Odontological Society of the Union of South Africa, and an associate fellow of the New York Academy of Medicine.

Hellman received, in 1937, an honorary citation as a testimonial to the diligence, experience, and skill which made his name a synonym for scientific devotion, for observational precision, and for breadth of understanding. This was awarded by the Associated Foundation in Laboratory of Anatomy, Western Reserve University, Cleveland, Ohio. In 1939 he was the recipient of the Albert H. Ketcham Memorial Award of the American Association of Orthodontists in recognition of his contribution to the science and art of orthodontics.

He was awarded the honorary degree of doctor of science by the University of Pennsylvania, in 1933 and again in 1938 by the University of Witwatersrand, Johannesburg, South Africa. In recognition of his scientific achievements, Hellman was awarded the keys of the Omicron Kappa Upsilon and Sigma Xi honorary fraternities.

Hellman's first official connection with orthodontics was as editor of Volume 3 of the *American Orthodontist.* In one of his editorials, in 1911, he quoted from Socrates: "Gentlemen, we are not arguing whether you or I am right, what we wish to ascertain is the truth of the question before us." Throughout his whole career, it was the desire for truth that constantly prevailed.

It is in Hellman's first paper, entitled "Bone Tissue, Its Growth and Development, a Résumé" (1912), that we find how he planned his future course, from which he never deviated: "Urged by the desire to learn in a general way what the scientific world may have contributed to this phase of our work, I gave a great deal of time in the pursuit of several studies with the aim in view to find some explanations pertaining to the complex problems we are called upon to solve. . . . I shall furthermore endeavor, by means of frequent comparisons, to arrive at some logical deductions that may prove of value in the practical application of orthodontia." From that time on, and with increasing regularity, there began to appear a remarkable series of papers and reports of his researches. For thirty-five years he tried to unravel the maze of problems that began on that day back in 1912.

In 1911 Dr. Angle had assigned to Hellman the by no means easy task of summarizing what bony tissue is, and especially its reactions to outside mechanical forces. The paper proved to be an excellent summary of earlier and contemporary literature in this field. It was followed, in 1914, by a paper sum-

marizing the experimental work of Dr. Oppenheim, then of Vienna, who had used orthodontic methods to move teeth of macaques into new positions and later studied microscopic sections of the jawbones, showing the response of the bony tissues to the treatment and the traumatic effects of the appliances.

It was through the studies of such men as Brash, Sir Arthur Keith, Campion, Gregory, and Todd that Hellman's work and interest in the field of growth and development of the human denture and face developed. "Since 1908 I [Hellman] have disciplined myself to measure skulls." The most important, most intensive, and most sustained effort of Dr. Hellman was his study of the development of the human denture and face, and this was one of the greatest of his contributions to the profession.

At the memorial meeting to Hellman in 1947, Dr. W. M. Krogman remarked that, in the science of physical anthropology, "He took a technique that was dead and static and vitalized it into one that was alive and dynamic. By this I mean that he adapted a series of measurements originally designed for adult skulls, and applied them to the heads and faces of *living* individuals—nay, more than living, *growing* individuals! Dr. Hellman was literally a pioneer in the *practical application* of anthropometric techniques. In his hand anthropometry (more precisely craniometry) justified its birthright as a precise science. It is in keeping with his use of precise measurement that Dr. Hellman brought to orthodontia a rigorous, uncompromising attitude of scientific objectivity; classification, diagnosis, and procedure were all subservient to a thorough study and analysis of each case under observation and/or treatment. If Dr. Hellman's attitude could be reduced to a single phrase, it would be: *Know* your patient—which really means know the *growth pattern* of your patient."

It was in the department of anthropology at the Museum of Natural History, then under Professors Boas and Wissler, that Dr. Hellman began his studies. The successive stages of the teeth, jaws, and bony face, from fish to man, were then the outstanding interest of the Museum. Professors Cope and Osborn had "long since made their brilliant discoveries and generalizations, and Osborn's system of naming the main cusps of the mammalian molar crowns was to vertebrate paleontology about what Angle's nomenclature of malocclusion was to orthodontics. Both systems had aroused healthy skepticism, and were later shown to be in need of minor corrections and emendations; but, in the active decades that followed, the Theory of Trituberculy and Angle's Classification of Malocclusion withstood well not only the attacks of unfriendly critics, but the discovery of countless new facts and the great widening of their respective backgrounds."

Hellman's basic work on the cranium was largely from the American Museum of Natural History, where he was Research Associate in Physical Anthropology; also he studied the skeletal and fossil material at the National Museum in Washington, first under Hrdlička; the Hamann Museum of Comparative Anatomy, Cleveland; the Hunterian Museum of the Royal College, in London, England; and the Transvaal Museum in South Africa.

It was in 1920 that Hellman offered the first paleontologic analysis of Angle's classification of malocclusion. "This paper pointed out the relationship of the mesiolingual cusp of the upper first molar to the occlusal fossa of the lower first molar was the last and most fundamental remnant of the evolution of the dentition of the mammal. This was very important, for Dr. Angle has placed great emphasis on the claim that the first molar and especially the upper first molars were the most stable teeth in their positions with reference to the skull in harmony with the pattern of the individual. He demonstrated the high percentage of upper first molar rotation, and this made the judging of the position of the first permanent molar from the buccal aspect alone confusing and deceiving; the rotation of these teeth so as to bring the mesiobuccal cusp into normal relation with the buccal groove of the lower molar as well as the mesiolingual cusp was necessary in order to obtain or maintain the normal relation of the teeth anterior to the first molar."

In 1919, in his article entitled "Dimensions Versus Form in Teeth and Their Bearing on the Morphology of the Dental Arch," he showed that the occlusal relations of the upper and lower molars in man, in lateral aspect, have assumed new and distinctly human characteristics; that in the lingual aspect the protocone of each upper molar fitted into the talonid fossa of a lower molar exactly as it does in most other mammals, both fossil and recent. He took this well-established fact in paleontology and made it the starting point of his later studies on occlusion.

In 1919 Hellman studied the relative diseases of breast- and bottle-fed babies. Here he early used statistical tools for this purpose. In 1921, in another paper entitled "Variations in Occlusion," he based his entire discussion upon the standard deviation and errors of the difference, saying: "We must use Johnson's newly proposed term 'Individual Normal' reservedly . . . I would prefer the phrase 'Individual variation.' "

On facial growth and dental development Hellman divided his work into seven groups representing periods of development:

> Stage I designates that period of early infancy before the completion of the deciduous dentition.
>
> Stage II designates the period of late infancy at the completion of the deciduous dentition.
>
> Stage III designates the period of childhood, when the permanent first molars are erupting or have taken their positions. . . .
>
> Stage IV designates the period of pubescence, when the second molars are erupting or have taken their position. . . .
>
> Stage V designates the period of adulthood, when the third molars are erupting or have taken their place.
>
> Stage VI designates the period of old age, when the occlusal surfaces of the molars are worn off to the extent of obliterating the pattern of the grooves.
>
> Stage VII designates the period of senility. . . .

In 1929, from prehistoric American Indians (Arizona) of both sexes, Hellman presented a diagrammatic profile of facial size, proportions, and position in each of the seven stages. From the very beginning, he accepted the fact that the growth of the face and its general craniofacial relationship must be measured in the dimensions of height, breadth, and depth (or length).

In 1937 and 1939, Hellman carried his use of the standard deviation a step further. He erected a vertical line which served as the average base line for each measurement taken. He called these standard deviation diagrams "wiggles." His fundamental postulates were: (1) growth in a three-dimensional system interplay of growth rate in time and in morphologic area and, (2) balanced integration of plane, rate, and morphologic area to give a normal individual face. This was his ground plan to know the normal that he might assess deviation from it—in kind and degree. A malocclusion was not necessarily an attained aberrancy—it was a growth process out of balance and out of harmony. Not treatment alone, but treatment with growth, was the answer.

Dr. Hellman's use of the dental age, in his stages, recorded his emancipation from chronologic age. In his "Ossification of Epiphysial Cartilages in the Hand," he concluded: "Ossification of the epiphysial cartilages of the hand occurs in four fundamental ways. (A) The cartilage disk narrows. (B) These disks show precipitation of bone or bud-like process of ossification. (C) These disks disappear entirely. (D) There is a differentiation of the bone structure in the ossified area. Stage A appears between 12 years 36 days and 12 years 11 months. Stage D completed between 14 years 3 months and 15 years."

Dr. Hellman finally concluded: "It may, therefore, be concluded that the period between the ages of 12½ and 14 years is replete with significant physiologic processes in this group of girls. The dentition of youth [M2] is completed, the epiphysial cartilages are undergoing the most active transformation and stature is increasing at its greatest rate. Moreover, accompanying these phenomena, processes are taking place that subsequently bring about pubescence."

In 1916 Dr. Gregory had used the phrase "Dryopithecus pattern" to designate a particular arrangement of the lower molar cusps and grooves in anthropoid apes. Dr. Hellman, in a joint paper with Dr. Gregory, was able to set forth much additional evidence that the Dryopithecus pattern of the lower molar was really fundamental in man as well as in the apes, and in 1928 Hellman showed that this pattern occurs in the first, second and third lower molars in descending percentage.

There are many phases of Dr. Hellman's contributions that I would like to consider, but space prevents this. One cannot conclude without mentioning his interest in education and especially his activities in the Eastern Association of Graduates of the Angle School of Orthodontia. This Association was always dear and near to him, and he gave it much of his attention and energy. Hardly a meeting occured at which he did not have something to contribute. A charter member, he served as its first secretary-treasurer in 1909-1910, as president in 1912-1913, as vice-president in 1911-1912, and again until his death in 1947. As a member of its Executive Committee, most of the time its chairman, he directed

its activities and due to his farsightedness, his background, wisdom, and contacts, he managed to keep its meetings on the highest scientific level, always steering away from papers on appliances, etc.

At one time (1927 to 1929) he held the chair of orthodontics at the New York School of Dentistry and was Professor of Dentistry at Columbia University. In 1933 he did research on growth of the face and jaws at Columbia University. At Harvard and at the University of Pennsylvania, he lectured to both the undergraduate and graduate students.

Hellman's interest in orthodontic education is lost in the maze of his writings; yet during his professional career it was uppermost in his mind. From 1914 to 1916 he worked on a program that would permit his alma mater to take over and continue the Angle School but, due to certain conditions laid down by Dr. Angle, he failed. Until the Eastern Association disbanded, Hellman still had hopes that, through it, something would materalize, and even when it disbanded he did not give up.

In bringing this sketch of the work of Milo Hellman to a close, I am reminded of what Darwin once wrote and how it might apply to him:

> My success as a man of science, whatever this may have amounted to, has been determined, as far as I can judge, by complex and diversified mental qualities and conditions. Of these, the most important have been the love of science, unbounded patience in long reflecting over any subject, industry in observing and collecting facts, and a fair share of invention, as well as of common sense. With these moderate abilities as I possess, it is truly surprising that I should have influenced to a considerable extent the belief of scientific men on some important points.

B. W. Weinberger

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Editorial

MAXIMUM IMPROVEMENTS IN CONGENITAL OROFACIAL CLEFTS

AT THE annual meeting of the American Association of Orthodontists in Boston, May 3, 1956, Dr. Herbert K. Cooper, Director of the Lancaster Cleft Palate Clinic, presented a paper entitled "Image Intensification With Cinefluorography and Sound Spectrograph as Aids in Treatment Planning for the Postoperative Cleft Palate Patient."

Although Dr. Cooper and his highly organized staff have been actively engaged for some time in original research in this new project, this occasion was the first formal presentation of its revolutionary development before the American Association of Orthodontists. It also marks a new epoch in history, wherein this vital subject will hold rank of great importance in the consolidation and standardization of cleft palate therapy in the future.

Dr. Cooper's paper appears concurrently in this issue of the JOURNAL; it is published with comprehensive illustrations and descriptive techinques of the cinefluorographic *motion picture film,* with the simultaneous sound recordings which followed the paper.

Every orthodontist with proper basic training and real experience has been called upon at one time or another in his practice for advice on or for the treatment of the various types of malocclusion peculiar to children with cleft palates. The force of the impact with which these highly variable and complex problems have to be met constitutes a very definite challenge to any orthodontist. Unfortunately, for monetary and other repellent reasons, this work is confined largely in private practice to those orthodontists whose sympathetic qualities provide the inspiration and challenge necessary in undertaking the efforts expedient to assist in the preparations required to achieve the ultimate goal of getting these patients properly prepared to tackle life. This situation among orthodontists may be only one of the many reasons and conditions common to the several ancillary services, which may be best accomplished under institutional or group clinic disciplines.

History has recorded the existence of congenital defects, including dentofacial clefts, at least as far back as the beginning of the fourteenth century. According to a recent report from a prominent New York hospital, out of 18,000 live births there existed twenty-two different kinds of congenital defects, including the previously recorded proportion of clefts lips and palates. A large number of these conditions were at least credibly correctable and their victims could be suitably clothed so as to present entirely different

functional appearances from those with defects of the orofacial area. Or, as Dr. Cooper draws a most appropriate comparision vocationally, "Many could walk to reach a job but few could ask to get it."

Contemporaneously during the past century there were two outstanding characters whose brilliant work went far to contribute to the background and substantially to foreshadow modern progress in this field which is undergoing such encouraging developments today. One was Norman W. Kingsley, M.D.S., D.D.S., 1850-1892, and the other was Calvin S. Case, M.D., D.D.S., 1871-1923.

Dr. Kingsley was known as the "Father of Orthodontia" and his textbook, written in the late seventies and published in 1880, remains a valuable record and reference today. It was entitled *A Treatise on Oral Deformities as a Mechanical Branch of Dentistry.* His text is replete with orthodontic appliances of the period, including jackscrews, plain arches with ligatures, a counterpart of the so-called Hawley retainer, and also an appliance designed for space closures in the extraction of first maxillary premolars. Kingsley also shows a large number of fracture splints, both interdental and with the famous occipital anchorage designed for both fracture and orthodontic purposes which still enlightens his name today. He was also famous as an artist, in both sculpture and portraiture.

In the construction of obturators he used the anterior superior spine of the Atlas bone—Passavant's cushion—as the target for his posterior extensions. He laid special emphasis upon speech and dwelt volubly on the subject, giving suggestions as to teaching, exercises, and practice for its improvement. It is interesting to note that both of these geniuses, Drs. Kingsley and Case, enjoyed such long professional careers and were brilliant orthodontists even though they excelled in many other pursuits.

Dr. Case was the author of a textbook written toward the culmination of his long career. It was a compilation which recorded the vast wealth of his experience and the great storehouse of his inspired genius. His book was entitled *A Practical Treatise on the Technics and Principles of Dental Orthopedia and Prosthetic Correction of Cleft Palates.* Dr. Case's orthodontic appliances were all "fixed" in nature and constituted a wide range of designs to meet the required forms of tooth movement. His appliances were all made of German and nickel silver and comprised a large number of stock parts from which the most ingenious designs were quite perfectly constructed. He was a liberal believer in the judicious extraction of teeth as a compromise or necessity more than as an accepted principle, as shown by records from his large practice. It was after his presentation of a paper on this subject that he became the target of brutal criticism and was all but condemned by Edward H. Angle and his satellites of that period for any such practice, a situation which he never outlived but which is entirely reversed now. Dr. Case also enjoyed several hobbies and possessed a characteristic and glowing personality among his friends.

Dr. Case paid glowing tribute to Dr. Kingsley as follows: "The longer orthodontia is practiced, the more respect the author has for the general teachings enunciated forty years ago and published in his inestimable text by

that most ingenious of men of his day, Dr. Norman W. Kingsley." They were both deeply involved "with the difficulties arising in certain conditions and the influences of natural laws which continue to engage our most earnest endeavors, often in the futile attempt at permanence of retention."

Dr. Case's prosthesis was named the "Velum-Obturator" and was held in position largely without attachments to teeth and consisted of a veil or hood made of black vulcanite which approximated the posterior wall of the pharynx, also the vicinity of the spine of the Atlas bone, and would be movable upward and downward in the modulations of sounds. Dr. Case was a stickler for "intelligent instruction" in the "art" of speaking correctly. He dwelt largely upon "practical teaching performed persistently." He stated that success in speech training would depend, "first upon the character and effectiveness of the surgical operation," second upon the "obturator" or speech-aid, and third upon the "ability and persevering determination of the pupil." Truly the pioneer skills of these men were forerunners of the modern concepts in the mechanisms of efficient speech production today.

Dr. Cooper's advent into this field was the result of a challenge after being appointed to the staff of the Pennsylvania Hospital for Crippled Children in 1928. This resulted in a series of observations of general dento-orthopedic deformities. After listening to a lecture before the New York Society of Orthodontists in 1936 by the late John J. Fitz-Gibbon of Holyoke, Massachusetts, another brilliant star in the rising firmament of cleft palate therapy, Dr. Cooper determined to add the cleft palate case to the other distoclusion and mesioclusion as associated with facial deformities. It was an interesting commentary that Dr. Fitz-Gibbon himself was born with a cleft palate and, in order to conquer his own problem, embraced dentistry through which training he became not only expert in the treatment of his own case but also was able to help the many patients who sought the benefit of his services. Through his persistence, the fine quality of his own voice became truly remarkable and he was among the pioneers in incorporating the judicious practice of orthodontics to great advantage in cleft palate therapy. Dr. Fitz-Gibbon was a proficient student of applied psychology as well as an expert in speech training, in which corrective exercises were performed by his patients through the means of phonographic and wire recordings of the sound of their own voices, of normal patterns, and of strengthening exercises.

Outstanding among the several revelations of Dr. Cooper's cinefluorograph is the brilliance with which the oropharyngeal area is projected in motion with simultaneous sound recording. The other factor vital to the perfection of this techinque which deserves emphasis is the remarkable protection of the patient, who is far inside the zone of safety as to any slightest danger of overexposure. Another discovery which is destined to become of great value is the placing of the "speech bulb" above the external tubercle of the Atlas bone, referred to as Passavant's pad or cushion. Future construction designed to target these speech bulbs into the pharyngeal fossa superior to the Atlas tubercle will not only reduce the volume of these objects, but will

so control the modulations of air-valving as to produce optimal improvements in posterior control of speech quality. This will also produce the effect of lightening the volume of the entire speech aid and minimizing the liabilities of "orthodontic" strains as to loosening or displacement of upper anchor teeth.

As a matter of fact, if a fair and unbiased appraisal will be made in the effects of speech efficiency between mechanical and surgical closures, this differential study should demonstrate the comparative advantages and disadvantages of both procedures, with strong implications as to their choice and necessary early surgical preparation for their selective development and use. Since congenital defects constitute an *absence* instead of a *loss* of structure in the residual area, it may be assumed that any form of procedure designed to substitute this absence may be "poor enough at best." Inasmuch as perfect hearing is vital to the production of "sound images" and "word pictures" in the "photographic mind," hearing must be protected, and the element of timing, which is indispensable to all existence, must be fully analyzed and taken advantage of in the anticipation of speech function. What a wonderful boon to humanity would it become, provided that all types of clefts could be classified in their original stages so as to establish the *selective advantages* and *disadvantages* between the nature of surgical and mechanical procedures. If it thus becomes obvious that one has a choice over the other in any given case, then any and all prejudices for or against one or the other should be abandoned. Dr. Cooper refers very generously to "group thinking" or "team approach" in "treatment planning." He emphasizes the fact that the tendency to allocate the group as to participating specialists in their "relative importance" *should be avoided.* He further states that this group will function best when the consultants, including the surgical service, agree to act in an *ancillary* capacity, and in the best cooperative interests of all concerned.

It is my personal conception that if congenital clefts are the *axle* of a wheel and the *hub* of the wheel constitutes the point of mobile contact, then these special services become the *spokes* of the wheel, the hub becoming the supporting object around which they have to revolve. The order in which these ancillary or supplementary services may be required on an age basis are as follows:

Surgery (lips and palate) in infancy

Pediatrics

Otolaryngology

Operative dentistry (primary, mixed, and permanent dentitions)

Orthodontics (typing, treatment-planning, primary dentition at 3 to 4 years of age)

Orthodontics (treatment guidance, mixed and young adult dentitions, pursuant to genetic progress.)

Surgery (revisional, lips and/or palate)

Speech therapy—selective

Psychometry (corrective and vocational appraisal)

Prosthetics (speech aids—tooth-bearing retention and lip plumperage)

Plastic surgery (nose and/or lips) young adults.

These various ancillary services, indicated in their chronological order, are not necessarily subservient or subordinate in nature, but are operable independently, each in its own designated capacity. Their comparative or relative value can be estimated only at such a time when one respective spoke in the wheel is *carrying the load* apace, with the others awaiting the time when their full value and importance can become effective. In Dr. Cooper's words, "Orchestration should include all these services in which no part of the symphony should be overemphasized." If any one of these basic prerequisites is neglected, then immediately the balance of the entire procedure is disturbed or broken.

As outlined in this paper, there are four principal objectives which are essential to the satisfactory conclusion of any given case: "masticating efficiency, esthetic facial and dental harmony, socially acceptable speech, psychological adjustment to the condition." It appears that many of our procedures, teachings, current texts, speech therapy, psychology, the better understanding of pressure habits, applied orthodontics, and orofacial surgery will have to be changed after this technique becomes more fully developed and accepted. It is definitely obvious that this image amplification has opened a new door and enlightened a visual sense heretofore largely unseen, with the anatomic parts in motion and speech in three dimensions.

Recognizing the need for "integrating, coordinating, and standardizing" these services, Dr. Cooper established what we believe to be the first clinic devoted to the materialization and execution of these ideals. As the herald of a new epoch, what a wonderful sense of security will follow the consolidation of principles and the coalescence of all therapies into the form of institutional efficiency in an ever-increasing and more positive service to mankind, wherein every individual may receive a maximum degree of improvement and become a useful citizen in the great victory of life!

As a pioneer in this field, Dr. Cooper has produced many valuable contributions to modern progress during the past twenty years. With characteristic enthusiasm, he has been inspired with unselfish zeal to bring this great humanitarian service up to the highest productive level. Since the installation of this cinefluorographic equipment as a diagnostic aid three years ago, many changes and improvements have been made in its efficiency and safety and in further research, resulting in the near perfection of its development to date. During this period much credit should be extended to Mr. F. Allan Hofmann, electronic engineer and Director of Technical Research, and Mr. Robert Millard, Chief of the Speech Department, who, with the clinical staff of the Lancaster Cleft Palate Clinic, have rendered invaluable assistance.

Dr. Cooper quotes from an editorial in the October, 1955, *Radiology Magazine* as follows: "Electronic engineers should be aware of medical problems in which electronics can be of help, and members of the medical or dental pro-

fessions should know where and how to present their problems to the engineers." With the aid of Mr. Hofmann in expert production and Mr. Millard in proficient studies in speech analysis, Dr. Cooper has produced an effective team. As the recipient of much credit and many honors, it is an interesting commentary that Herbert Cooper has also visualized this problem through the eyes of an orthodontist. Being thus enabled to continue from this present stage in their unselfish pursuit of factual evidence, this will not only exercise a convincing influence in a new future but they are destined to provide a revealing solution to the numerous ramifications of the cleft palate problem.

J. D. E.

RETIREMENT BENEFITS*

ON AUG. 1, 1956, President Eisenhower signed the expanded Social Security bill that provides coverage after 1955 for all workers and self-employed persons with the exception of physicians and certain Government employees. This law provides Social Security benefits for nearly 80,000 dentists engaged in private practice.

Under this recent legislation, protection is provided for the family, based upon earnings of the insured. Correspondence reveals, however, that there is some confusion about two different and separate bills. The one passed and signed on August 1 is the extension of Old-Age and Survivors Insurance coverage under the Social Security Act to certain self-employed professional groups.

Now still another is pending, called the Jenkins-Keogh bill, which provides for an enactment of an amendment to the Internal Revenue Code to permit certain taxpayers to defer tax liability on income tax paid toward an individual retirement program. This legislation, known as H. R. 9 and H. R. 10, is currently pending before the House Committee on Ways and Means. It is important, then, to understand that retirement and survivorship security under the Old-Age and Survivors Insurance title of the Social Security Act is an entirely separate consideration from retirement and survivorship security under the Jenkins-Keogh proposal. The difference between the two approaches is the Old-Age and Survivors Insurance program, which is intended to provide the minimum benefits necessary for a subsistence standard of living. The Jenkins-Keogh proposal is intended to provide second benefits for retirement or survivorship purposes that would complement Old-Age and Survivors Insurance benefits and would raise the living standard of the recipients above the subsistence level to one that more nearly approximates the standard of living attained by the recipient during his productive years.

*Much of this information was gleaned from the Social Security Act and the Jenkins-Keogh bill, and a reprint of a short article by Rep. Eugene Keogh (Democrat, New York) explaining difference between Social Security and individual retirement act proposed in the Jenkins-Keogh bill. Basic literature is available from the Committee on Retirement Benefits, American Bar Center, Chicago 37, Illinois.

Another difference between the two approaches to the problem of security arises from the nature of the two programs. The one—Old-Age and Survivors Insurance—is a form of compulsory social insurance that is provided by law to guard against destitution and poverty in a person's declining years or under circumstances of dire adversity. The other—the Jenkins-Keogh bill—is a tax benefit to practice individual thrift according to a person's needs. The Jenkins-Keogh bill is also a matter of tax equality and equity, designed to provide eligible persons with treatment, under the tax laws, that is comparable to that afforded a large segment of the population under the pension and profit-sharing provisions of Federal tax law.

The Jenkins-Keogh bill failed to pass at the last session of Congress. This bill, if passed, would have enabled all self-employed persons to save a small portion of income each year upon which Federal income taxes would be deferred until retirement, when presumably they would be in a lower tax bracket. Such retirement benefits are presently enjoyed by most employed persons, including practically all members of labor unions.

To accomplish this objective, a committee of lawyers in every state of the union is at work at the grass-roots level with senators and congressmen. The American Bar Association is trying very hard to alert all other professional groups of self-employed persons to the importance of this proposed legislation. The American Bar Association points out that fair tax principles embodied in the Jenkins-Keogh bill have been before Congress for more than a decade. Now —before the Eighty-Fifth Congress convenes next January—the American Bar Association has decided to assemble the full strength of the legal profession behind the principle of "equal tax rights for the self-employed."

Here are some of the major points set forth by the American Bar Association:

"The lifetime income curve of a professional man usually rises slowly in early years, advances rapidly to a peak where it stays for a few years, then declines gradually. The problem in these days of steep income taxes is how to lay something aside from peak-earning years to provide for the rainy day.

"As you know, moneys paid in to these trusteed or insured plans by an employer are deemed a business expense and constitute a tax deduction for the employer. More important to the employee is the fact that he does not have to pay any income tax on his company's contribution, or the increments thereto, until the benefits actually are paid out. Ten million self-employed taxpayers have no such tax deferment."

The Jenkins-Keogh bill, now amended, would allow a self-employed professional man (with exceptions) to deduct from gross income each year a limited amount of earned income contributed by him to a restricted retirement fund or paid in as premiums to purchase a restricted retirement annuity contract. He can deduct annually up to $5,000.00 or 10 per cent of earned income, whichever is less, but not more than a total of $100,000.00 during his lifetime.

An individual who has reached age 55 before the effective date is allowed to deduct an additional amount, to help him build up an adequate interest in the fund or obtain more than a token annuity. In his case, the normal deduction limit is increased by the lesser of $500.00 or 1 per cent of his earned income, multiplied by the number of years his age exceeds 55 (with a maximum overage credit of twenty years).

On attaining age 65, or earlier under certain conditions, he will get back his contributions to the fund plus their accumulated earnings in one of three ways elected by him: (1) a lump sum; (2) annual, quarterly, or monthly installments over a period of years, or (3) one or more single premium life annuity contracts.

The problem of providing family security is just as important for lawyers, dentists, and others named in the bill as it is for corporation officials and factory workers, and high income taxes now make that difficult out of current earned income. It seems, therefore, that the retirement security of members of these professions engaged in private practice requires both the extension of Old-Age and Survivors Insurance coverage and the availability of equal treatment under Federal tax laws. In the last Congress, the Jenkins-Keogh Act of 1955 was introduced to help you set aside a part of your earnings for retirement and deferment privileges long available to those who work for themselves. Dentists should be just as alert to this important pending legislation as all other groups who would benefit by this legislation now pending as a new bill.

H. C. P.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Emergence of Permanent First Molars in the Monkey (Macaca Mulatta). Association With Other Growth Phenomena: By V. O. Hurme and G. Van Wagenen, Forsyth Dental Infirmary for Children, Boston, Massachusetts, and Department of Obstetrics and Gynecology, Yale University School of Medicine. *Yale J. Biol. & Med.* **28**: 538-567, 1956.

The material studied consists of the dental records of twenty-seven male and forty-two female macaques born and reared in the monkey colony of the Department of Obstetrics and Gynecology at the Yale University School of Medicine.

An analysis is presented of certain long-term records on the growth and development of sixty-nine normal macaques born and reared in captivity. Particular attention has been paid to permanent first molar emergence and to other growth changes observable in the monkey prior to 2 years of age.

The emergence of teeth is characterized by considerable variability, which increases with age, if measured in conventional units of time. The hypothetic extremes of permanent first molar emergence are approximately twelve months apart for the teeth of males and seven months apart for the teeth of females.

Chronological asymmetry may appear in the eruption of a tooth and its antimere. Generally speaking, as variability increases with age, so do temporal asymmetries in the emergence of right and left teeth.

The longer the period of intrauterine development, the sooner after birth do the teeth appear, as a rule.

The findings indicate a close association between developmental rates and tendencies to deviations from the biometrician's average. Rapid rates of odontiasis are characterized by lesser degrees of chronological variability than slow rates of dental maturation.

Although the eruption of one tooth is interlinked with that of another, this linkage is not so rigid as to make observations on the sequence of emergence of various teeth the best method for demonstrating the high degrees of constancy in the developmental patterns of different animals. The first molars initiate odontiasis of the permanent series, the mandibular molars usually preceding the maxillary ones.

Multiple emergence of certain deciduous teeth seldom takes place in a slowly maturing animal, and a high proportion of males with a slow rate of dental development reveals a transitory anatomic pattern which is generally characteristic of females.

The analyses suggest that the rates of odontiasis are casually related, in some manner, either to the length of gestation or to something else which determines the duration of gestation. In either case, it is apparent that the basic

"rhythm" of tooth emergence is determined prior to birth and that it is less alterable than the behavior of an individual dental organ.

All findings on physical-dental intercorrelations emphasize the idea that the growth and development of the dental organ complex are dependent on the growth and development of the entire body.

Eruption of teeth serves as an excellent indicator of both physiologic and chronological age. Making use of this indicator requires the keeping of detailed long-term records on a large number of separate dental units.

It appears that animals which mature at different rates are unequally susceptible to similar environmental stimuli or agents. Attention to rates of dental maturation should enable the experimental biologist to design more critical laboratory studies. The odontologist is in a strategic position for supplying information that is necessary for formulating a theoretical basis for the differentiation of phenotypes and genotypes.

J. A. S.

News and Notes

1957 Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry or associated with it as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art and science of orthodontics.

Prize.—A cash prize of $500.00 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if, in its judgment, none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be in English, typewritten on 8½ by 11 inch white paper, double spaced with at least 1 inch margins. Each sheet must be numbered and bound or assembled with paper fasteners in a "brief cover" for easy handling. The title of the essay should appear on the "brief cover." Three complete copies of each essay, including all illustrations, tables, and bibliography, must be submitted. The name and address of the author must not appear in the essay. For purpose of identification, the title of the essay, the author's name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.) should be typed on a separate sheet of paper and enclosed in a plain sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held in New Orleans, Louisiana, May 13 through 16, 1957.

Judges.—The entries will be judged by the Research Committee of the American Association of Orthodontists.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate on or before Jan. 10, 1957, by Dr. J. William Adams, Indiana University, School of Dentistry, Indianapolis, Indiana.

Alton W. Moore, Chairman, Research Committee
American Association of Orthodontists
University of Washington
School of Dentistry
Seattle 5, Washington

American Association of Orthodontists, 1957 Research Section Meeting

Continuing the policy of recent years, the program will consist of a series of ten-minute research reports which may be presented orally or read by title only. All persons

engaged in research are urged to participate in this program, which will be held May 13 through 16, 1957, in New Orleans, Louisiana.

Each participant is asked to prepare a 250-word abstract for publication in the AMERICAN JOURNAL OF ORTHODONTICS. Abstract for publication and the ten-minute oral presentation at the meeting should be carefully prepared to present an adequate description of the import of your investigation.

Forms for use in submitting the title and 250-word abstract of your research will be sent to each dental school orthodontic department and to any individual requesting one. Please send your title and abstract as early as possible, but not later than Jan. 10, 1957, to Dr. William B. Downs, Graham Building, Aurora, Illinois.

Alton W. Moore, Chairman, Research Committee
American Association of Orthodontists
University of Washington
School of Dentistry
Seattle 5, Washington

Southern Society of Orthodontists

The thirty-fifth annual session of the Southern Society of Orthodontists was held at the Greenbrier Hotel, White Sulphur Springs, West Virginia, Aug. 19 to 22, 1956.

The Society was organized in Atlanta, Georgia, Feb. 23, 1921, with the following charter members: Clinton C. Howard, president; J. A. Gorman, vice-president; Oren A. Oliver, secretary-treasurer; W. B. Childs; Carroll C. Johnson; Thomas T. Moore, Jr.; Donald Morrison; Thad Morrison; and Harle L. Parks.

The following appeared on the program of the thirty-fifth annual meeting. A. C. Broussard, New Orleans, Louisiana, president of the American Association of Orthodontists; F. C. Shelden, Kansas City, Missouri; Paul V. Reid, Philadelphia, Pennsylvania; F. N. Weber, Memphis, Tennessee.

The meeting also featured the following clinics:

The Precious Metal Removable Appliance. Samuel D. Gore and Samuel D. Gore, Jr., New Orleans, Louisiana.

Variability of Headcaps. William M. Ditto, Greensboro, North Carolina.

Twin-Edge—Combination Twin Wire and Edgewise Techniques. Eston E. Mullinix, West Palm Beach, Florida.

The Dynamics of Growth in the Individual. George H. Prewitt, Lexington, Kentucky.

Prevention and Treatment of Incipient Malocclusion. Richard F. Scherer, Winston-Salem, North Carolina.

Extraoral Therapy in Conjunction With Twin Wire Appliances. Joseph S. Meadows and Charles H. Smith, Atlanta, Georgia.

Steel Bands in My Office. Clyde O. Wells, Spartanburg, South Carolina.

Clinical Photography. Herbert D. Jaynes, Atlanta, Georgia.

(1) Fabrication of Stainless Steel and (2) Appliance Construction in Stainless Steel. Nathan G. Gaston, Monroe, Louisiana.

Making Bands Fit. Frank B. Truesdell, Richmond, Virginia.

Positioner Treatment. W. Burnie Bunch, Jacksonville, Florida.

A New Radiograph Cephalometer Also Capable of Oriented Temporomandibular Joint Radiography. Walter D. Sandusky, Jr., Memphis, Tennessee.

Occlusal Guide Plane Therapy. Wendell H. Taylor, Andalusia, Alabama.

Case History, Hereditary Dentinogenesis Imperfecta. Donald Morrison, Gainesville, Florida.

Orthodontic Problems. R. Burke Coomer, Louisville, Kentucky.

Extraoral Forces—Philosophy and Treatment. James Jay.

American Association of Orthodontists
New Orleans, the Crescent City

The mighty Mississippi, cutting a serpentine course past New Orleans on its way to the Gulf of Mexico, 110 miles distant, forms a huge crescent in which is located a large portion of the city. It is because of this location that New Orleans is often referred to as the "Crescent City."

Aerial view of New Orleans, Louisiana, where the 1957 meeting of the American Association of Orthodontists will be held May 12 to 16, 1957. This photograph was taken at dusk.

In the foreground of the accompanying photograph is the Huey P. Long railroad and highway bridge. A second highway span, now under construction, will cross the river from the business district near the top of the crescent.

Off to the left, not in the photograph, is Lake Pontchartrain. Connecting New Orleans with the north bank of the lake is a recently completed bridge more than twenty-three miles long. It is believed to be the longest bridge in the world.

When you attend the meeting of the American Association of Orthodontists here May 13 through 16, 1957, you will not only profit from an excellent scientific program but you will take back many interesting memories of the Crescent City.

Make your reservations now through Dr. Bertney G. Frick, 1231 Maison Blanche Bldg., New Orleans, Louisiana.

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Roosevelt Hotel in New Orleans, Louisiana, May 7 through 11, 1957. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Dr. Wendell L. Wylie, University of California, School of Dentistry, San Francisco 22, California.

Applications for acceptance at the New Orleans meeting, leading to stipulation of examination requirement for the following year, must be filed before March 1, 1957. To be eligible, an applicant must have been an active member of the American Association of Orthodontists for at least two years.

Denver Summer Meeting for the Advancement of Orthodontic Practice and Research

The Denver Summer Seminar, now known as the Denver Summer Meeting for the Advancement of Orthodontic Practice and Research, was founded in 1936. It is dedicated to the memory of the late Albert H. Ketcham of Denver, Colorado.

Original founders of the Denver Summer Seminar who attended the meeting held in Denver, Colorado, July 29 to Aug. 3, 1956.

Bottom Row: William R. Humphrey and Lynn Carman, both of Denver, Colorado.

Top Row: Cecil Mueller, Omaha, Nebraska; Arch Brusse, Denver, Colorado; and John O'Donnell, Wichita, Kansas.

The accompanying photograph shows some of the original founders of the Seminar who were present at the last meeting, which was held at the Brown Palace Hotel in Denver, July 29 to Aug. 3, 1956. Two original seminarians were absent, namely, Brooks Bell of Dallas, Texas, and George H. Herbert of St. Louis, Missouri.

Kansas State Orthodontic Society

The Kansas State Orthodontic Society was formed in Wichita, Kansas, on Sept. 9, 1956. Two-day meetings will be held twice each year.

The following officers have been elected:

President: J. Victor Benton, Wichita, Kansas.
President-Elect: John W. Richmond, Kansas City, Kansas.
Secretary-Treasurer: Howard H. Dukes, Kansas City, Kansas.

Société Françiase d'Orthopédie Dento-Faciale
(French Society of Dentofacial Orthopedics)

The thirtieth meeting of the Société Française d'Orthopédie Dento-Faciale will be held in Paris, France, May 30 to June 2, 1957. Members of the American Association of Orthodontists who are going to visit France next spring are cordially invited to attend this meeting.

For further information, write Madame L. Muller, President, 31 rue de Moscou, Paris 8e, France.

Robert Moyers Lectures in Scandinavia

The Specialists Exchange Division of the Department of State invited Dr. Robert Moyers, head of the Department of Orthodontics at the University of Michigan, to present several lectures in Scandinavia under their auspices during the months of August and September, 1956.

Dr. Moyers has just returned from this mission, after appearing before a number of orthodontic groups and dental schools in Europe.

University of California

The University of California School of Dentistry announces a refresher course in orthodontics, etiology, and rationale of treatment by Prof. Gustav Korkhaus, D.D.S., M.D., of Bonn, Germany. The course will be given Saturday and Sunday, Nov. 17 and 18, 1956.

This course is designed to acquaint American dentists with research and treatment procedures developed by Dr. Korkhaus and his colleagues in Europe. The following points will be covered: etiology-diagnosis-treatment by appliance of Andresen extraction, self-correction, early treatment, the loss of teeth in jaw development, and many others.

Notes of Interest

Dr. Frederick W. Black announces the removal of his office to 3666 Kendall Ave., Cincinnati, Ohio.

Dr. Walter Coolidge Chapin is now located in the new Medical Center, 140 Lockwood Ave., New Rochelle, New York, practice limited to orthodontics.

T. W. Fellows, D.D.S., M.S.D., announces the opening of his office at 217 First National Bank Bldg., Bozeman, Montana, practice limited to orthodontics.

C. Douglas Hoyt, D.D.S., announces the removal of his office to 907 River Rd., Fair Haven, New Jersey, practice limited to orthodontics.

Frank Kanter, D.D.S., 2 East 54th St., New York City, announces the opening of an additional office at 175 Main St., White Plains, New York, practice limited to orthodontics.

Louis B. Kelsten, D.D.S., announces the opening of his office at 111 East Northfield Rd., Livingston, New Jersey, practice limited to orthodontics.

Dr. Barney B. Kennedy, orthodontist, announces the removal of his office to University Plaza A, 500 East Woodrow Wilson, Jackson, Mississippi.

OFFICERS OF ORTHODONTIC SOCIETIES

THE AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

Forthcoming meetings of the American Association of Orthodontists:
1957—Roosevelt Hotel, New Orleans, Louisiana, May 12 to 16.
1958—Commodore Hotel, New York, New York, April 27 to May 1.
1959—Statler Hotel, Detroit, Michigan, May 4 to 7.

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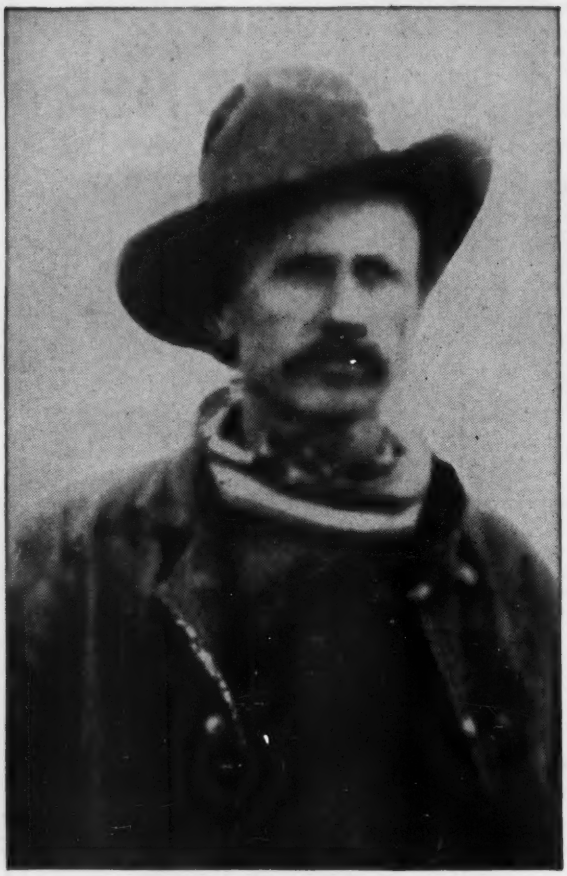

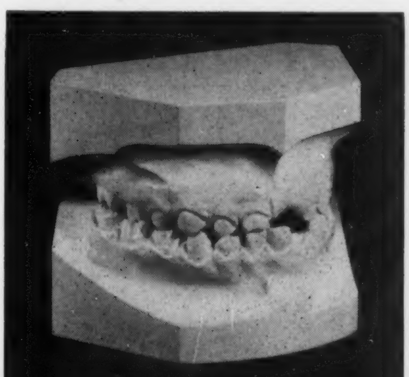

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